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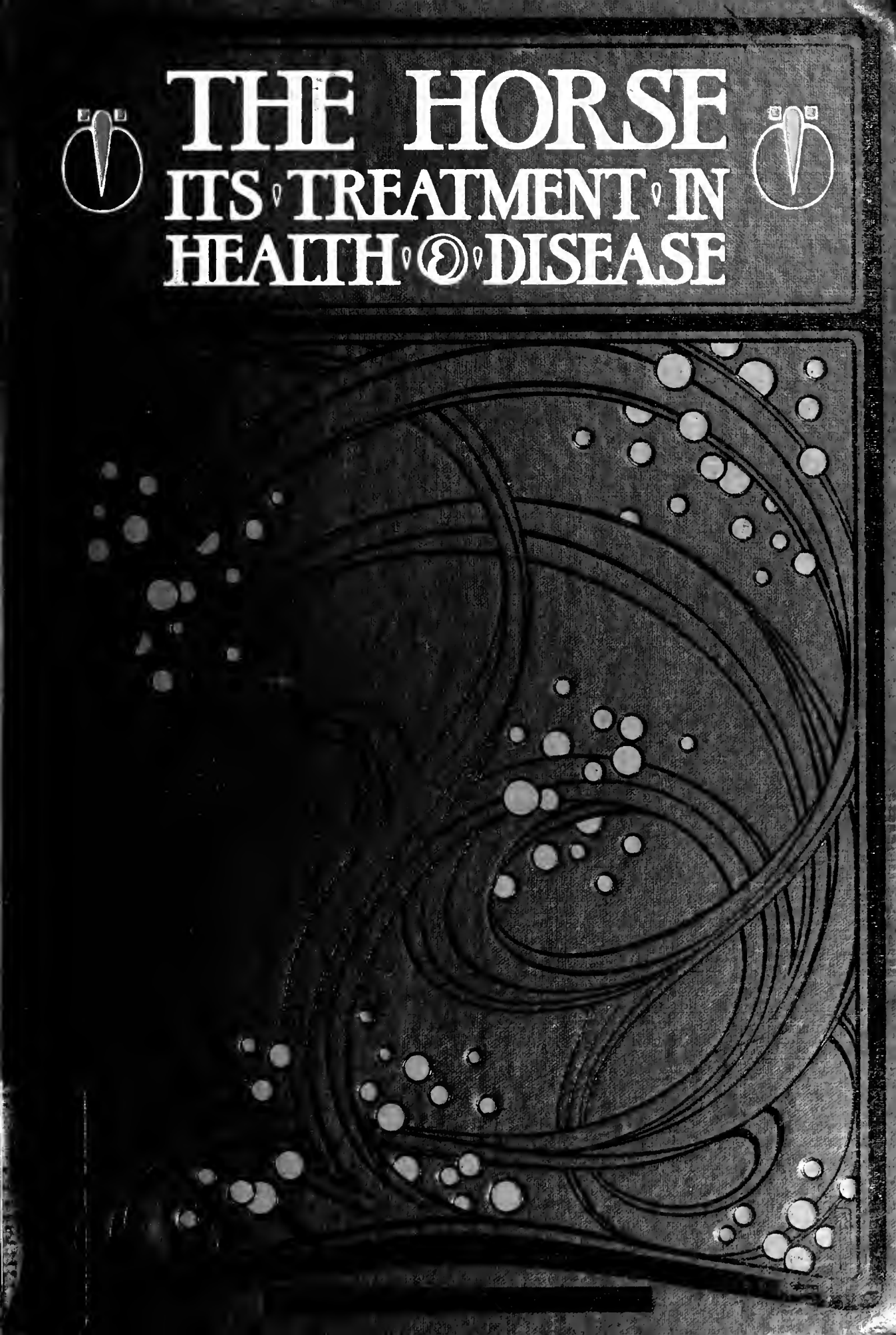

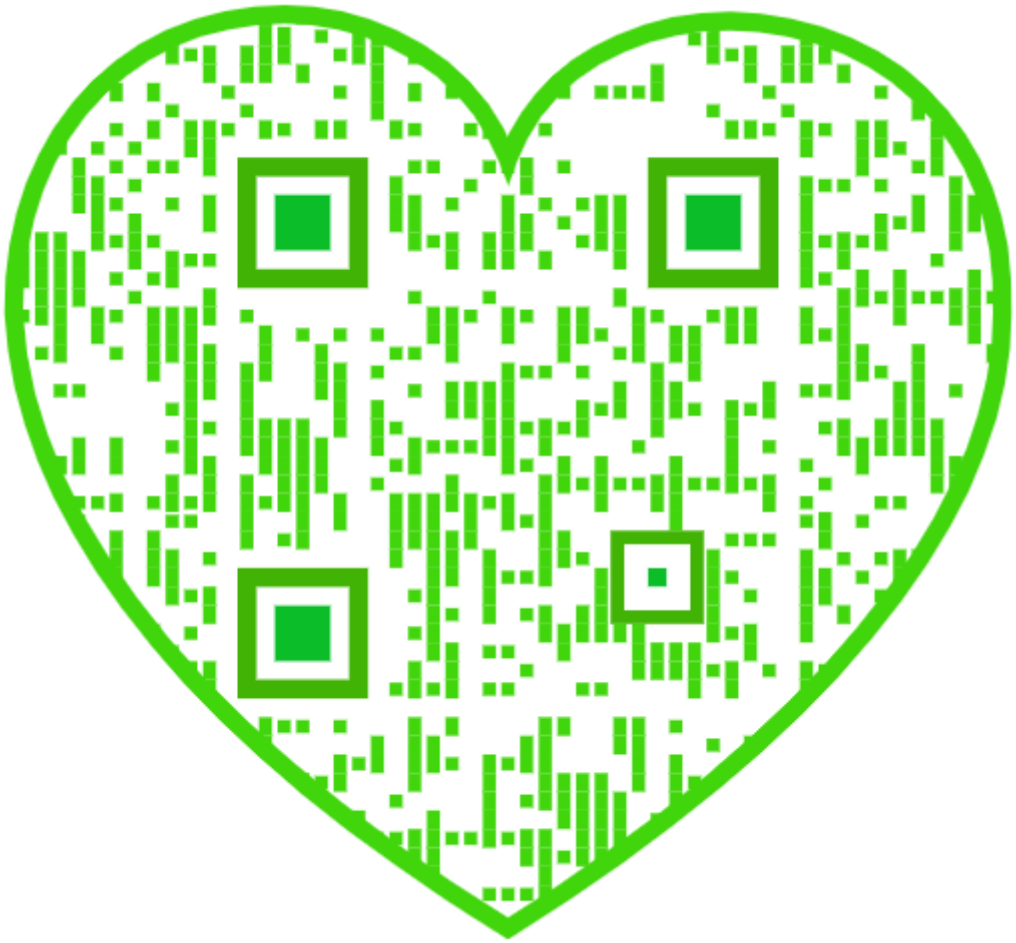

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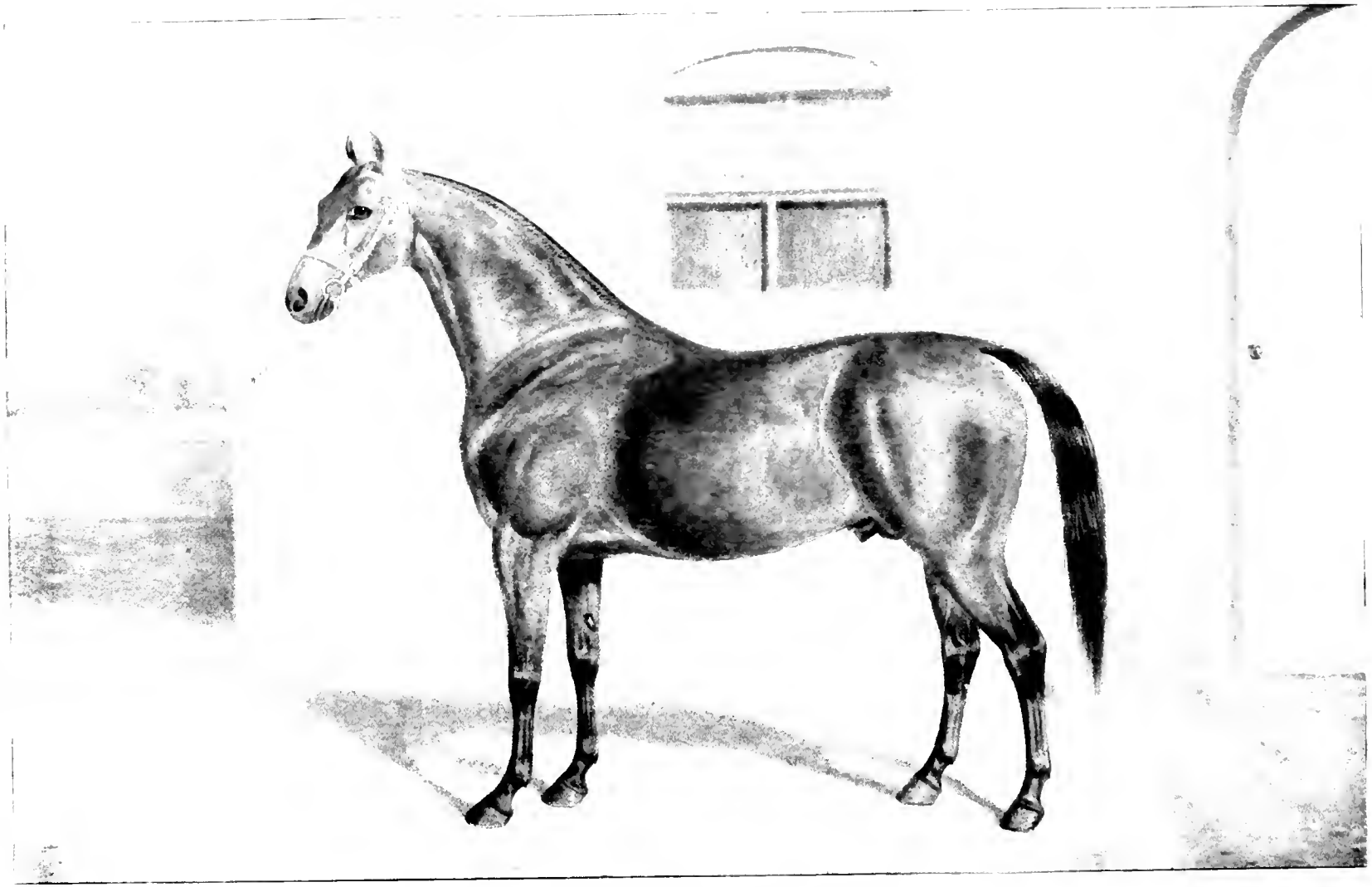

YORKSHIRE COACH-HORSE, MISCHIEF

ITS TREATMENT IN HEALTH AND DISEASE

WITH A COMPLETE GUIDE TO BREEDING
TRAINING AND MANAGEMENT

Edited by

PROF. J. WORTLEY AXE, M.R.C.V.S.

Ex-President of the Royal College of Veterinary Surgeons
Late Lecturer at the Royal Veterinary College, and at the Agricultural Colleges of Downton and Wye
Chief Veterinary Inspector to the Surrey County Council
Consulting Veterinary Surgeon to the British Dairy Farmers' Association

Author of "The Mare and Foal" "Abortion in Cattle" "Anthrax in Farm Stock"
"Examination of Horses as to Soundness" "Glanders, its Spread and Suppression" "Swine Fever"
"Lithotomy or the Removal of Stone from the Bladder of the Horse"

DIVISIONAL VOLUME V

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PARASITES DERIVED FROM THE PLANT WORLD

Classification.—Parasitic plants belong for the most part to the large family of fungi. Their history is in many points obscure, and the various attempts at classification have not been entirely satisfactory. For the present purpose, however, it will be sufficient to refer to three divisions: schizomycetes, saccharomycetes, and actinomycetes. The schizomycetes include the fungi which multiply by division or fission, the saccharomycetes or yeast fungi multiply by budding and the formation of spore, actinomycetes include the fungi the branches of which radiate from a centre-rayed fungus. Individuals of the two first divisions are found on the surface of the body and in the internal organs of the horse, but so far as is known very few of them produce disease.

PARASITES DERIVED FROM THE ANIMAL KINGDOM

Classification.—Animal parasites are divided into three classes:—1. Protozoa. 2. Helminths. 3. Arthropodes.

Protozoa include all organisms of the most simple form—the mere beginnings of life, in reality—from the small structureless mass of living material (bioplasm) to the different forms of cells consisting of a simple investing membrane containing nuclei or sometimes only granular material. Cells assume various forms—circular, oval, elliptical, and elongated.

Protozoa include amœbæ, sporozoa, and infusoria. Amœbæ have no defined outline, but consist of small masses of living material capable of moving in any direction, and feeding upon particles of food which they find in the fluid in which they live. Those particles they appropriate by enclosing them in the jelly-like material of which they are composed.

Sporozoa are divided into gregarines, coccidia, and psorosperms. They have a more definite form than amœbæ, as they are bounded by a cell-wall and contain spores or nuclei. All of these primitive forms of life inhabit stagnant pools, and are consequently taken in by animals which are feeding on the pastures. Their presence has frequently been recognized in the digestive organs of animals, but it is only of late years that the truly parasitic character which some of them assume has been realized. Fatal outbreaks of disease among pheasants and poultry have been traced to the invasion of *coccidia*, and the presence of the same organism in the ducts of the liver of the rabbit has probably been responsible for a considerable mortality among those animals. The true significance of these lowest forms of parasitic life in the organs of warm-blooded animals is not yet fully appreciated.

Helminths (Worms).—Between the highly organized parasites which are described as worms and the elementary forms which have just been referred to there do not appear to be any connecting links; at least none have been discovered. The word worm is popularly believed to indicate creatures of which the earth-worm is an example, but the helminthologist includes in the term animals which differ considerably from each other in form, sufficiently, at least, to lead to their division into two sub-classes, the characters of which are very easily distinguished.

In the first subdivision—round-worms or helminths—all the members have the characteristic forms of the common earth-worm, that is to say, they are round and elongated; but they differ in length from an eighth of an inch to several feet, in other words, from very large to extremely minute worms which can only be seen by the aid of the microscope.

Round-worms are found in various parts of the body of their host—in the skin, the eye, stomach, intestines, in the kidneys, and occasionally in the heart and blood-vessels.

The second subdivision includes all flat-worms (flat helminths). There are two varieties of them, which are known as tape-worms and fluke-worms; the latter being entirely unlike the typical worm, as it resembles a very minute sole, and when it is fully grown it is little more than an inch in length.

Both round-worms and flat-worms produce eggs in which embryos are developed, but it is characteristic of all the division that the young worms do not become mature in the organism of the animal which they infest; in some cases the young worm is hatched out in the intestines or other organs of the host, but before it is fully developed it appears to be necessary that it should be expelled and find an intermediate host outside the animal in which it has lived. In the case of the round-worm this phase in their life-history is still obscure; the intermediate host has not been discovered. In the flat-worms, on the other hand, the changes have been followed from the egg through the body of the intermediate host back to the class of animal originally infested. In the fluke, for example, the embryo bores its way into a small snail, in which it goes through certain changes of form. In the case of the tape-worm the embryo in the body of an intermediate host becomes a hydatid, which is really a small bladder in which the tape-worm head is developed. The transference of the hydatid to the body of another host is followed by the development of the tape-worm from the head or heads. The only mystery which exists in reference to this parasite relates to the identification of the host, which in a considerable number of tape-worms is not known, although, judging from analogy, there can be no doubt of its existence. To make this mode

of development clear a simple illustration will be sufficient. A certain hydatid infesting the brain of the sheep, which causes the disease known as *gid*, will, if given to a dog, be developed into a tape-worm possessing certain well-defined characters which mark its origin. The mature segments of this variety of tape-worm, when given to sheep or taken up by them when feeding on pastures, will produce the hydatid in the brain.

Arthropedes.—In this division is included all animals with jointed limbs, all kinds of insects which, either in their mature or larval form, become parasitic permanently or temporarily to any of the higher animals.

Horses are infested by the larval forms of certain flies (diptera), and by some varieties of lice and acari or mange-mites, which produce diseases of the skin of the animals which they infest.

DISEASES WHICH ARE INDUCED BY PARTICULAR PARASITES

EXTERNAL PARASITES OF THE HORSE

Numerous parasites belonging both to the animal and plant kingdoms take up their residence on or in the skin of the horse, and occasion considerable derangement. The common affection which is known as ringworm, on account of the circular form which the eruption assumes, is due to a fine hair-like fungus which is known as the *Trichophyton tonsurans* or ringworm fungus. Other parasites of the skin are derived from the animal kingdom, as lice, which, without producing any specific affection, cause a great deal of irritation and interfere with the animal's condition. Acari or mites, which cause different forms of mange; larvæ (maggots) of certain insects which take up a temporary residence on the skin, and bore their way into it, or are thence transferred by the animal itself, in the act of licking or biting, to its own stomach, where they undergo a certain amount of development prior to quitting their hold and being expelled to complete the necessary changes to form the perfect insect. Certain small thread-worms, and a lower form of organic beings belonging to the protozoa, known as psorosperms, also infest the skin.

RINGWORM OF THE HORSE

It may be observed at the commencement that ringworm in the horse is a comparatively rare affection. In cattle it is constantly found in young animals; very rarely, however, is it seen in an animal after the age of one year. In the horse age does not appear to afford any protection from the disease.

Symptoms.—In consequence of the common occurrence of a form of eczema, in which the eruption is distinctly circular, the term ringworm is frequently applied to that disease, which is not associated with the presence of a fungus and is not contagious in its character. In eczema the round patch which characterizes the eruption is developed at once, but in ringworm it commences as a small pimple and spreads day by day in widening circles until a rounded patch is produced. True ringworm is in all cases due to the growth of the fungus (*Trichophyton*) in the hair follicles, and frequently in the interior of the hair, and the diagnosis of the disease implies the detection of the fungus under the microscope. For this purpose a few hairs and a certain small proportion of scab should be removed from one of the spots of the skin, placed in a little solution of potash, with a few drops of glycerine added, in order to render the opaque scabs transparent. If the disease is ringworm the appearance presented will be that which is indicated in Plate XXXVI, figs. 9 and 10.

Fig. 272.—Ringworm

Another method of diagnosis has been suggested, which, taken in connection with the clinical symptoms, *i.e.* itching and the appearance of gray scabs along the back, the sides of the withers, and, in bad cases, on the neck and head, may lead to a correct conclusion; but absolute proof of the nature of the disease can only be obtained by microscopic inspection. The method proposed is as follows:—A few drops of chloroform are allowed to drop on one of the suspected spots; if, after the evaporation of the fluid, some of the hairs present a white or pale-yellow colour, it is concluded that the disease is ringworm.

Two varieties of ringworm have been distinguished by writers—the common kind, in which the scab is gray and the hairs are inclined to break

off short at the mouth of the follicle, owing to their brittle condition; and another form, in which the scabs are yellow, and the hairs, instead of breaking off, fall out and leave perfectly bare patches of skin. This variety of the disease does not appear to have been recognized in England.

Treatment.—It is a somewhat remarkable character of this disease that while the eruption extends from the centre of the scab by constant distribution of the spores there is a well-defined limit to its progress, and at a certain point the disease undergoes a spontaneous cure. This has been noted particularly in ringworm of calves, and there is no doubt that the continuance of the affection in many cases is largely dependent on the general weakness and poor condition of the subject. The average duration of ringworm in the horse is said to be forty to fifty days, but it must be understood to mean that in regard to a certain spot or a certain number of spots a cure will be evident by the growth of new and healthy hair. Meanwhile, however, any advantage from this spontaneous cessation of the affection is often neutralized by the constant conveyance of the spores (seeds) of the fungus to the other parts of the skin. Consequently it happens that as fast as the affection is cured in one place it breaks out in another; hence the necessity for the prompt use of remedies which will destroy the vitality of the fungus as quickly as possible.

Various agents are employed in the treatment of ringworm, and it may be said of nearly all of them that they are perfectly successful, for, unlike the ringworm of the human subject, ringworm in the lower animals is not difficult to cure. Among the agents which are recommended are a solution of corrosive sublimate, 1 to 300 of water, to which a little spirit has been added, or a mixture of 1 part carbolic acid with 10 parts of glycerine. These preparations are to be applied by means of a brush to the spots of ringworm wherever they are found. Of the ointments which are commonly employed, blue mercurial ointment, and red biniodide of mercury, each diluted with six times its bulk of lard or vaseline, are most effective. The treatment in any case will have to be continued until a healthy state of the skin is indicated by the growth of new hair in all parts of the diseased skin.

Transmission of ringworm to other horses, probably also to other animals, and certainly to human beings, is likely to take place unless proper precautions are used. Care therefore should be taken to cleanse and disinfect thoroughly the stable and its fittings, destroy the litter, and disinfect or destroy all the stable apparatus used about the diseased animals.

For the protection of the helper who dresses the animal the shirt-sleeves should be kept down instead of being turned up, as is usually done,

as experience proves that the arms are the parts most likely to be attacked.

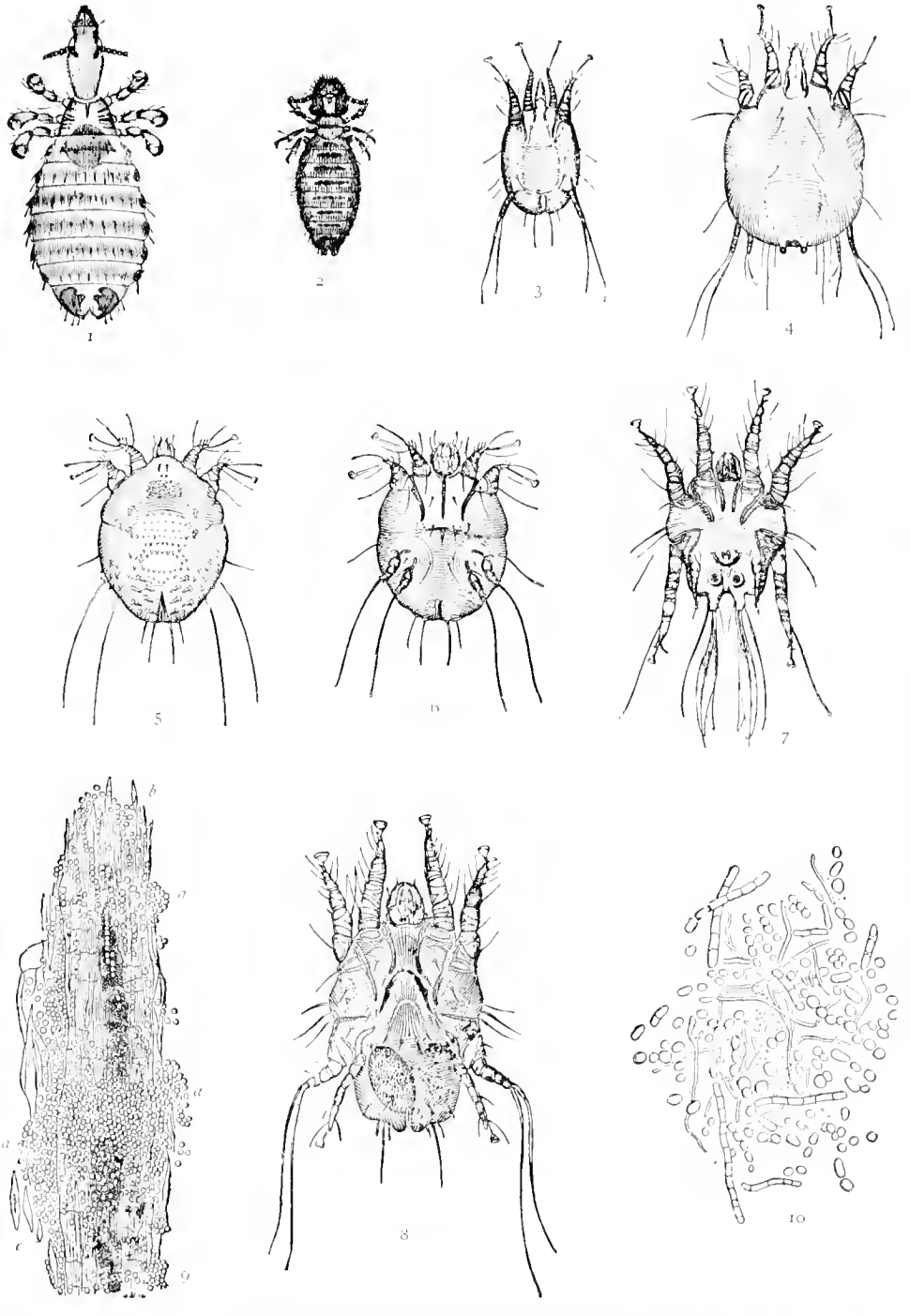
PARASITES OF THE SKIN DERIVED FROM THE ANIMAL KINGDOM

The skin of the horse is infested by several varieties of parasites, which occasion disease of the structures, attended with itching, and in some cases with considerable eruption. The two most common affections are known by the terms *phthiriasis*, when lice are present, and *acariasis*, when different kinds of acari invade the skin. The latter are the cause of several forms of mange.

Phthiriasis (Lousiness).—Lice which infest the skin of the horse are of two kinds: one which, by its sharp-pointed mouth, is able to puncture the skin and live on the blood, hence called *Hæmatopinus*, and another the head and mouth of which are not adapted for puncturing the skin; this variety feeds on the loosened cuticle and clings to the hair, hence the name, *Trichodectes*, which is given to it. The two varieties are commonly found together. In very young animals lice are frequently extremely abundant, and by the constant irritation which they produce they prevent the animal from feeding or resting in any comfort. It is consequently important to employ some dressing which will have the effect of killing the parasites. Various agents are in favour for this purpose; the most simple is any kind of fat oil which will destroy the lice by stopping their breathing pores, as train-oil and linseed-oil. Mercurial ointment is a very effective remedy, but it is also very dangerous. Tobacco water, made by boiling an ounce of tobacco in a quart of water, is also a very good dressing, or, instead, a solution of carbolic acid 1 part to 50 parts of soft soap and water may be used.

In consequence of the invariable presence of numerous eggs on the skin, which will in all probability escape the action of the dressing, it is necessary to repeat it in a week. Afterwards the animal must be examined occasionally in order to ascertain if any more parasites are present. The illustrations in Plate XXXVI, figs. 1 and 2 show the different varieties of lice found on the skin of the horse.

Acariasis (Mange).—The parasites which belong to this division are the different varieties of ticks and mange-mites. The presence of ticks on the skin may be looked upon as an accidental circumstance, from which the horse in its state of domestication is comparatively exempt. The same, however, cannot be said of the invasion of the mange-mites, two varieties of which are commonly found in the horse, one (*Psoroptes*) the cause of



EXTERNAL PARASITES OF THE HORSE—After Neumann

1. Hæmatopinus macrocephalus equi, female, × 15.
2. Trichodectes pilosus equi, female, × 15.
3. Psoroptes communis equi, hexapod larva, × 60.
4. Psoroptes communis equi, pubescent female, ventral surface, × 60
5. Sarcoptes scabiei equi, ovigerous female, dorsal surface, × 60.
6. Same as 5, but ventral surface, × 60.
7. Symbiotes communis equi, male, ventral surface, × 60
8. Symbiotes communis equi, ovigerous female, ventral surface, × 60
9. Horse's tail invaded by trichophyton tonsurans, × 200. *a a*, mass of exterior spores; *b*, split summit of hair; *c*, cells of epidermis of hair
10. Trichophyton tonsurans, × 350.

common mange and the other a burrowing mite (*Sarcoptes*) the ravages of which induce a more severe kind of skin disease, which is difficult to cure owing to the mites burying themselves under the cuticle.

Symptoms.—In all forms of mange the prominent symptom in the first instance is itching, which induces the animal to bite and rub itself, sometimes so vigorously as to cause abrasion of the skin. The disease is first apparent on the withers, the upper part of the neck, the root of the mane. Ultimately it may reach the head, and indeed most parts of the body excepting the extremities. An examination of the skin will lead to the detection of small pimples, and elevations of the cuticle from the exudation which goes on beneath it. The formation of scabs all over the affected surface follows, and these become confluent as the disease advances. Scabs, if violently removed, disclose a raw surface beneath.

A peculiar form of mange in the extremities, due to the presence of a variety of mange-mite, which is known as the *Symbiotes* on account of being found in clusters or colonies, occurs in the horse, but is only rarely detected, as the itching which induces the animal to rub and bite its legs is generally ascribed to other causes. The acarus usually locates itself in the hind fetlocks, but occasionally it attacks all four limbs, and it is commonly found in cases of grease. The symbiotes appear to be particularly active at night, and a knowledge of this fact is important, because when a horse is found to kick at the stall-post or strike his hind- or fore-feet constantly on the floor of the stable during the night, there is reason to suspect the presence of this form of mange (symbiotic mange), and a careful examination of the extremities should be made. The discovery of the symbiotes in the loosened cuticle of the legs will furnish satisfactory evidence of the nature of the disease.

The varieties of mange are to be distinguished with absolute certainty only by microscopic examination of the hair and scabs taken from the parts of the skin which are most affected. The examination is comparatively easy. Scrapings from the diseased parts have to be placed in a drop of water on the slide, teased out with dissecting needles, and covered in the usual way with a thin covering glass, and examined with the half-inch objective. The three varieties of mange-mites which have been mentioned are illustrated in the accompanying plate (Plate XXXVI, figs. 5, 6, 7, 8), and there will be no difficulty in distinguishing them by comparing them under the microscope with the figures.

Treatment.—Under ordinary circumstances mange in the horse is amenable to treatment, but when sarcoptic mange is allowed to run its course, the rapid multiplication of the parasites, and the damage which they do to the skin, and the consequent irritation which results, frequently

lead to fatal consequences, and it has been found necessary, on several occasions when the disease has assumed this virulent form, as it does among ponies which are left to run wild in mountain districts, to apply the stamping-out system in order to check the progress of the disease by the slaughter of the affected animals.

Mange frequently attacks horses in large working establishments, but is comparatively unknown in well-managed stables, in which horses are treated with particular care. In the present day it is never allowed to spread, even where horses are congregated in very large numbers, but is at once arrested by proper treatment.

It very commonly happens in large establishments, where animals are under veterinary supervision by contract, that mange dressings are among the remedies which are kept at hand, and as the veterinary surgeon employed pays periodical visits of inspection, the first symptoms of disease are noted, and the remedies are applied at once.

As a preliminary to any form of medical treatment it is essential that all the affected parts of the skin should be thoroughly washed with hot water and soft soap, applied by means of a hard brush, in order that all the scabs may be removed, so that the agent used may reach the surface of the skin. In instances where the scabs have become exceedingly thick and hard it is recommended to use the curry-comb to remove them.

Preparations of mercury, carbolic acid, sulphur, turpentine, and tobacco are commonly used as dressings, and perhaps it may be said that the selection of the remedy is of less importance than the manner of its application. One thorough dressing will prove more effective than any number of partial and intermittent applications which leave certain diseased parts untouched.

Dressings must of course be repeated, and in each case preceded by a thorough washing, until the cessation of the disease is indicated by the growth of new hair and the absence of itching. This can be ascertained by rubbing the skin and watching for movements of the animal's mouth, which certainly occur if any irritability remains.

Mange, like all parasitic diseases, is classed as a contagious affection simply because the acari may migrate from a diseased animal to others, or some of the eggs may be transferred by the agency of clothing or stable implements. It is therefore necessary to adopt precautions in all cases by disinfecting or destroying such articles as soon as the disease is cured.

PARASITES OF THE DIGESTIVE SYSTEM OF THE HORSE

Numerous organisms derived from the animal and also from the plant world inhabit the digestive system of the horse. The majority of them may be passed over with very slight notice, as it has not yet been proved that they are responsible for any morbid conditions, although it is extremely probable that some of them do produce various forms of derangement which are referred to other causes. Among the vegetable parasites are numerous fungi, such as the common mould, and others which belong to the same family. These fungi are found in the mouth, and thence quite through the digestive track.

The parasites which are derived from the animal world are extremely numerous throughout the digestive system.

Beginning with the lowest forms of life, there are found many of the sporozoa and infusoria, some families of which, the *Coccidia*, are met with in the liver and the epithelial cells of the mucous membrane. But in the horse it has not yet been demonstrated that any special disease attends their presence.

Coming to the more important parasites, there are first to be considered the worms which infest the stomach of the horse.

In this country the minute nematode discovered by Professor J. Wortley Axe in the stomach of the ass, and two varieties described by Professor Peuberthy in the horse, and the larvæ of the *Œstrus equi*, or stomach bot (fig. 273), are the only parasitic worms of the stomach of the equidæ; but two varieties of spiroptera, the megastoma and microstoma, are described by Continental helminthologists. The spiroptera, like the *Strongylus auri* (Cobbold), form small round tumours in the mucous membrane. No special signs of illness appear to attend the presence of these worms in the stomach. With regard to the larvæ of the bot-fly, which are found in clusters attached to the cuticular membrane of the stomach, opinions are very much divided, some authorities contending that they produce irritation in the stomach, and sometimes even bore their way completely through the coats of that organ. The rule, however, is that they simply penetrate the mucous membrane sufficiently to enable them to retain their hold until the time comes for them to quit their temporary habitation and assume the pupa, or chrysalis stage, in which the perfect fly is developed.

The next illustration was taken from a portion of the stomach, showing the small tumours of the spiroptera and a number of bots attached to the membrane.

A smaller variety of the bot, of a reddish colour, is sometimes seen clinging to the anus; it is known as the *Œstrus hæmorrhoidalis*.

The eggs of the bot-fly are deposited on the hairs of the horse's legs in the early summer, and they are soon hatched by the sun. The newly-hatched larvæ by their movements cause a certain amount of irritation and are licked off by the horse, and in this way are quickly conveyed to the stomach, to the mucous membrane of which they at once attach themselves by means of the hooked mandibles with which they are provided. The larvæ remain attached to the cuticular membrane of the

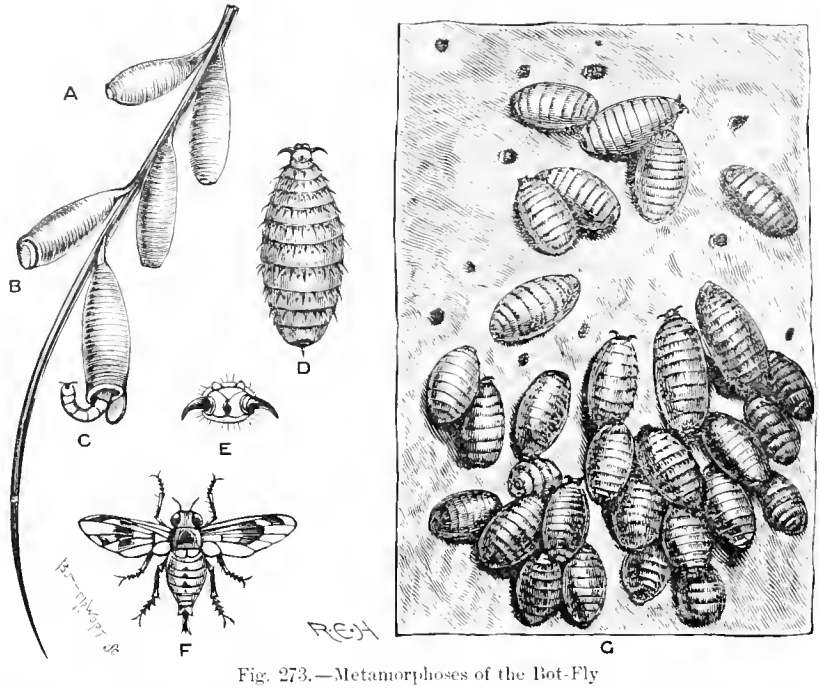


Fig. 273.—Metamorphoses of the Bot-Fly

A, Egg of Bot-Fly as it appears stuck on a hair. B, Egg of Bot-Fly, showing the Operculum or lid. C, Lid pushed aside and the larva escaping. D, Larva fully developed after having been in the stomach of the horse. E, Head of Larva, showing Hooklets by which it anchors on to the mucous membrane of the stomach. F, Bot-Fly developed from D. G, Larvæ of Bot-Fly anchored on to mucous membrane of the stomach of the horse.

stomach for some months, probably the greater part of a year. When sufficiently developed they relax their hold and are expelled. It may be noted here, however, that treatment is of no avail; there are no safe remedies which will cause the bots to abandon their position until the proper time. But the fact of quitting their hold naturally calls attention to their existence, and the use of any remedy at this period is sure to be attended with an apparent success.

The smaller red variety, the *Œstrus hæmorrhoidalis*, deposits its eggs on the lips of the horse, whence the larvæ are transferred to the stomach. They are much less common than the larvæ of the *Œstrus equi*.

Of the nematodes which infest the intestines of the horse a large white or pale-yellow worm, the *Ascaris megalocephala*, is the most common.

The worm varies in length from 3 or 4 inches up to a foot or more, and it is occasionally present in such enormous numbers in the small intestines as to fill them completely, necessarily causing a good deal of disturbance. Occasionally a worm passes up the pancreatic duct, and now and then one is found in the duct leading to the liver. When in sufficient numbers to cause obstruction in the intestinal canal they are said to cause symptoms of colic, giddiness, epilepsy, and tetanus; but when only a few are present they do not seem to cause any inconvenience. The illustration represents the general form of these worms of small dimensions (fig. 274).

Fig. 274. Ascaris (about ½ nat. size)

Various remedies are used for the expulsion of these worms, among them arsenic, calomel, tartar emetic, carbolic acid, turpentine; and recently santonine has been employed, and has proved to be more reliable than any of the other agents. The dose for a horse is 15 grains in a ball, with 3 or 4 drachms of aloes. The medicine should be repeated in a week.

Another of the nematode worms is the whip-worm (*Oxyurus curvula*), which infests the large intestines and occasionally excites irritation of the anus, which is indicated by the horse constantly rubbing the tail. A marked symptom of the presence of oxyurides is the accumulation of yellow dust-like matter around the anus. This is made up of the eggs of the parasite.

Fig. 275.—Oxyurus of Horse—Female (natural size)

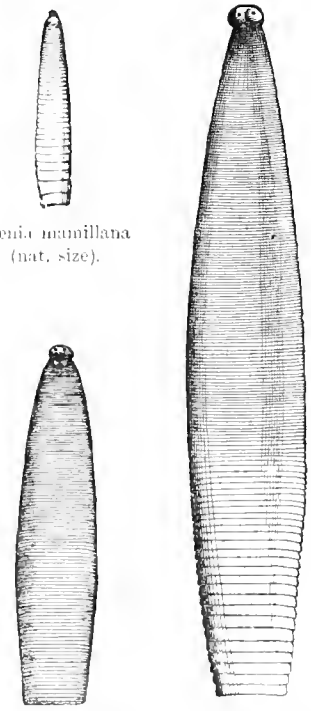
vu, Vulva.
a, Anus.

The expulsion of these worms is much assisted by occasional enemas of salt and water. An illustration of this worm is given in fig. 275.

Two other nematode worms are found in the intestine of the horse. Both of them deposit their eggs beneath the mucous membrane, giving rise to small tumours. The two parasites are known as (1) the *Strongylus armatus* and (2) the *Strongylus tetracanthus*. The latter is the most common and the most destructive. The *Strongylus armatus* is distinguished by its large mouth, which is armed with a row of cutting teeth arranged close together. The *Strongylus tetracanthus* has, in addition to the row of teeth like the *Strongylus armatus*, four large spines, from which the name is derived, and also inside the mouth a row of sharp hooks. It will be evident, therefore, that the creature is well provided with offensive weapons. The worm is constantly found accumulated in the large bowel, frequently in company with the *Strongylus armatus*.

In young animals a serious mortality is often caused by the invasion of this worm in large numbers, as both the parent worm and the young ones are true blood-suckers, and the embryos begin their ravages as soon as they escape from the cysts in which they are coiled up under the mucous membrane, in the manner seen in the illustration below, which is taken from a portion of the cæcum.

In the case of these two parasites, medical treatment has not hitherto proved very successful. Turpentine, chinosol, perchloride of iron are the most promising remedies. Colts, the animals which suffer most from the invasion of the parasite, may receive santonine in doses of 10 grains in a ball, or mixed with the food every day for three or four days, to be followed by a dose of linseed-oil.



Tænia mamillana (nat. size). Tænia perfoliata (nat. size). Tænia plicata (nat. size).

Fig. 276.—Tape-worms

Other nematodes have been described by writers, but they are not of very frequent occurrence, and it does not appear that they have been found among horses in this country. Information regarding them may be found in Neumann *On Parasites*, from which work some of the illustrations of the present chapter are reproduced.

Very few of the parasites of the next class, cystic worms or flat-worms (flat helminths), inhabit the intestines of the horse.

The common name tape-worm is given to these parasites. In the horse the few tape-worms which infest the intestines are remarkable for their small size in comparison with other varieties which are found in cattle, sheep, and dogs.

The three varieties are: the *Tænia perfoliata*, which is something under 2 inches long and $\frac{3}{8}$ inch in width; *Tænia plicata*, about $3\frac{1}{2}$ inches long and $\frac{3}{8}$ inch in width; and *Tænia mamillana*, which is about an inch in length, and a little more than $\frac{1}{8}$ inch in width. (Fig. 276.)

The *perfoliata*, which is most common, is distinguished by the presence of a peculiar appendage, forming a kind of collar, round the neck. The parasite inhabits the cæcum, seldom being seen in other parts of the intestinal canal. (Fig. 277.)

Tænia plicata is said to be found in the small intestine; sometimes in the stomach (fig. 278). The *Tænia mamillana* (fig. 279) is also said to

exist in the small intestine, but there is no record of its having been found among horses in this country. All these tape-worms are peculiar in being unarmed, that is, are not provided with a double row of hooks, which

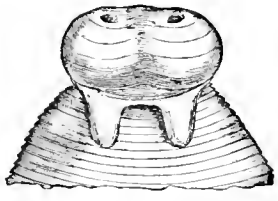


Fig. 277.—Tænia perfoliata, Cephalic Extremity (enlarged 7 diameters)

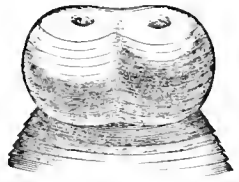


Fig. 278.—Tænia plicata, Cephalic Extremity (enlarged 7 diameters)

Fig. 279.—Tænia mamillana, Cephalic Extremity (enlarged 15 diameters)

are common in other varieties. Nothing is known of the hydatid stage, which forms the intermediate condition between the tape-worm embryo and the mature parasite.

There are no indications whatever of the existence of the worms during the life of the horse which they infest, and consequently no treatment has ever been attempted. A remarkable case is recorded of the existence of nearly all the parasites which have been described in one horse which was examined by Veterinary Surgeon Krause. There were found 519 *Ascaris megalocephala*, 191 *Oxyurus curcula*, 214 *Strongylus armatus*, many thousands of *Strongylus tetracanthus*, 69 *Tænia perfoliata*, 287 *Filaria papillosa*, and 6 *Cysticercus fasciolaris*.

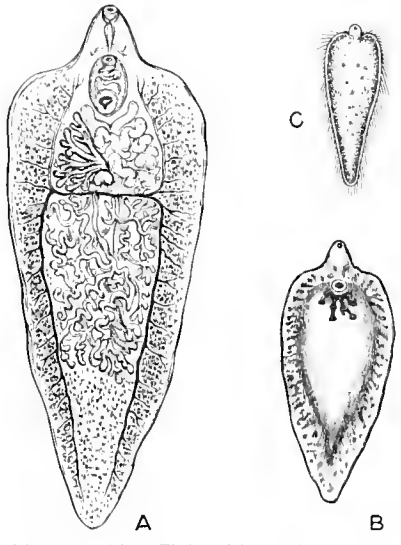


Fig. 280. Liver Fluke (*Distoma hepaticum*, Linn.)

A, Showing Anatomical details. B, Natural size. C, Ciliated Embryo, or Young Distome.

To complete the history of the parasites which infest the digestive organs of the horse it is necessary to allude to some which are found occasionally in the liver. The fluke (*Distoma hepaticum*) (fig. 280) sometimes effects an entrance into the liver ducts of horses, especially colts, which are feeding on wet pastures where the embryos and larval forms of the parasite are abundant. Sheep, as is well known, are destroyed in thousands in some localities by the invasion of this parasite, which causes the disease known as rot. A few cases are recorded of foals and colts having suffered from the accidental invasion of the fluke, but the disease among horses must be looked upon as

entirely exceptional. The fluke is not one of the worms which finds a host in that animal under ordinary circumstances.

Another parasite which is found in the liver of the horse is the cystic stage of an extremely small tape-worm found in the intestines of the dog, the *Tænia echinococcus*. The worm, when fully grown, is on an average about $\frac{1}{4}$ inch in length, and never exceeds $\frac{1}{2}$ inch, but in its cystic (hydatid) stage it is one of the largest which exists.

The *Cysticercus echinococcus* is found frequently in the liver, and occasionally the lungs, of cattle and sheep; the cysts varying in size from that of a grape to that of an orange, as a rule, but now and then they are found of an enormous bulk. Each cyst contains a fluid in which are found floating a number of tape-worm heads, myriads of which are observed growing on the interior of the cyst. In one form of the parasite small cysts, or daughter-vesicles as they are called, are found abundantly in the fluid. This peculiarity has given rise to a division of the parasite into two classes:—

1. The *Echinococcus altriciparíens*, in which the secondary vesicles exist.

2. The *Echinococcus scoliciparíens*, in which they are replaced by the small spots on the membrane, and in the fluid the tape-worm heads (*Scolices*).

The presence of these hydatids in the liver and other organs of animals is often not attended with any indications of disease, even when the liver is so filled with the cysts as apparently to replace the normal structure.

On the serous membrane of the chest and abdomen small wandering *echinococcus* cysts are occasionally found. There is also a nematode worm (*Filaria*) which has been found in the peritoneal and pleural cavities of the horse, ass, and mule. It does not appear to have been recorded, however, among the parasites of the horse in this country.

In the circulatory system of the horse, parasites are occasionally encountered, as the Surra parasite, found in the blood of horses in India, and the embryos of the *Strongylus armatus* and *Strongylus tetracanthus*, which locate themselves in the anterior mesenteric artery, and cause a well-marked aneurism. It is comparatively common in the ass. Parasites in the nerve-centres, or in the organs of special sense of the horse, are extremely rare. There is one case recorded by Woodger of the presence of a hydatid in the brain of a horse. In this case the animal suffered from the same kind of giddiness and tendency to turn in one direction as is known to be characteristic of a sheep similarly affected with hydatid in the brain, and there are a few cases reported of the discovery of the embryos of the armed *Strongylus* in the blood-vessels of the brain.

Cases have also been reported of the presence of bots (larvæ of the *Œstrus equi*) in the brain cavity of the horse, and also in the spinal canal of a pony.

Among the organs of special sense, the eye of the horse seems to be the only one which is invaded by parasites. It is recorded that Van Setten removed a pentastome from the right eye of a horse, and in horses in India the presence of a nematode worm is extremely common. The parasite is easily removed by puncturing the cornea and allowing the aqueous humour to escape, carrying with it the worm.

A minute worm (*Filaria palpebratus*) is occasionally found under the eyelids of the horse, causing irritation, with swelling of the eyelids and an abundant secretion of tears.

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14. ORGANS OF LOCOMOTION—BONES

COMPOSITION OF BONE

All bones are made up of two parts: 1, an organic matrix; 2, mineral matter or bone-ash. If the rib of a horse be macerated for a few days or weeks in dilute hydrochloric acid, the mineral or earthy matter will be dissolved out of it and the animal or organic matrix will remain behind. In this condition it still retains its original form, but, having lost its hardening constituents, it is now soft and flexible, and may be bent in any direction like a piece of india-rubber, or even tied in a knot.

If a second rib be placed in a bright clear fire and burnt, all the animal matter is destroyed and driven off, leaving the earthy substance behind as a white brittle mass, and, as in the previous experiment, still retaining the shape of the bone.

The relative proportions of organic and inorganic matter entering into the formation of bones vary at different periods of life. In young animals the former makes up nearly one-half of the whole, while in the adult it is reduced to nearly one-third, the remaining two-thirds comprising earthy or mineral substance. It is on account of the larger quantity of soft organic matter they contain that the bones of young animals are so much more yielding, and therefore less liable to break, than those of older ones. The earthy substance of a bone consists of phosphate and carbonate of lime in the proportions of 56 per cent of the former and about 13 of the latter. The animal matrix, which is a kind of gelatine, makes up the rest.

STRUCTURE OF BONE

When a long bone is cut through it is found to consist of a hard outer shell of *compact tissue* enclosing a looser portion made up of thin bony plates, interlacing with each other to form a number of spaces, and called spongy or *cancellated tissue*. In the centre of this is a cavity (*medullary cavity*) containing a soft reddish-yellow substance, the *medulla* or *marrow*. The compact substance is thick in the shaft of the bone, but thin towards the extremities, which are chiefly made up of cancellated structure.

All bones are covered with a dense tough fibrous membrane termed *periosteum*. It serves as a matrix in which the blood-vessels ramify and

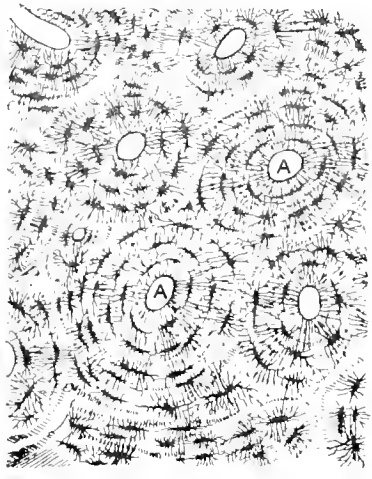


Fig. 281.—Transverse Section of Bone

A A, Haversian Canals. The small irregular black spots are the Lacunæ; the lines radiating from them are the Canaliculi.

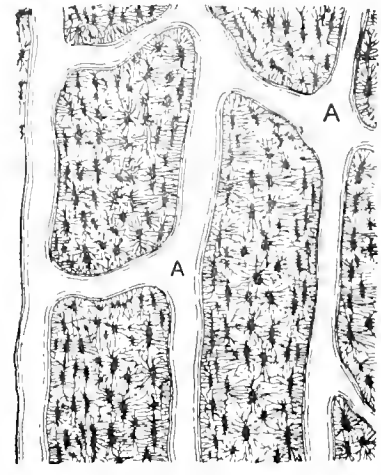


Fig. 282.—Longitudinal Section of Bone

A A, Haversian Canals.

break up into smaller and smaller branches, prior to entering into the bone tissue through small openings on its surface. A similar fibrous membrane, though more delicate, also lines the interior of bones, and is known as *endosteum*. This membrane is very thin, though rich in blood-vessels, and affords nourishment to the inner portion of the bone and to the marrow contained in it. Besides the vessels passing into the interior from the periosteum, the long bones have also a *nutrient artery*, for which a special opening is provided in the shaft of the bone called the *medullary foramen*, and others less considerable situated around the extremities (*articular foramen*).

The intimate structure of bone can only be made out by microscopic examination under a power of 300 to 400 diameters. Although bone looks

SKELETONS OF HORSE AND MAN

(The same figures indicate the corresponding parts in each)

1. Skull.
2. Atlas.
3. Dentata.
4–8. Cervical vertebræ.
9–27. Dorsal vertebræ.
28–33. Lumbar vertebræ.
34–38. Sacral vertebræ.
39–52. Coccygeal vertebræ.
53. Ribs.
54. Sternum.
55. Scapula.
56. Humerus.
57. Elbow-joint.
58. Olecranon.
59. Ulna.
60. Radius.
61. Pisiform bone.
62. Lunar bone.
63. Cuneiform bone.
64. Os magnum.
65. Uniform bone.

a. Carpus.

66. Small metacarpal.
67. Large metacarpal.

b. Metacarpus.

68. Sesamoid bone.
69. Fetlock-joint.
70. Os suffraginis.
71. Os coronæ.
72. Os pedis or pedal bone.

c. Phalanges.

73. Navicular bone
74. Innominatum.
75. Tuberosity of ischium.
76. Hip-joint.
77. Femur.
78. Patella.
79. Stifle-joint (true knee).
80. Fibula.
81. Tibia.
82. Os calcis (true heel).
83. Astragalus.
84. Cuboid.
85. Os magnum.
86. Os medium.
87. Os parvum.

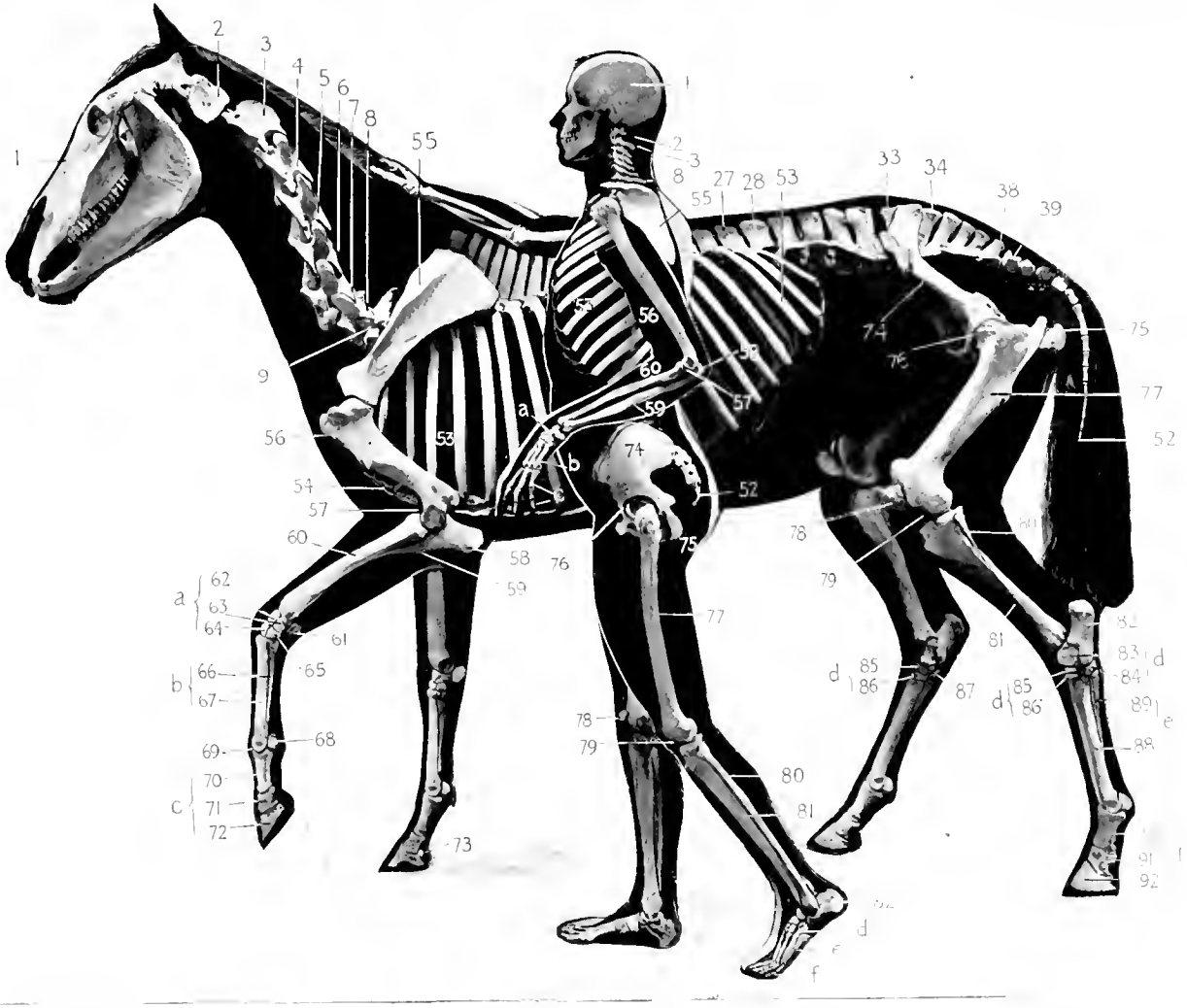
d. Tarsus.

88. Large metatarsal.
89. Small metatarsal

e. Metatarsus.

90. Os suffraginis.
91. Os coronæ.
92. Os pedis or pedal bone.

f. Phalanges.



SKELETONS OF HORSE AND MAN

By permission, from the Mounted Skeletons in the Natural History Museum, South Kensington

the hard material that it is, we have already pointed out the provisions which exist in it for an ample supply of blood to circulate in its interior, and repair the waste of tissue that is here as elsewhere constantly taking place. How this is effected will presently be seen.

If a very thin transverse section of bone (fig. 281) be made, and subjected to the scrutiny of the microscope, it will be found to present a definite order of arrangement of its several parts, conspicuous among which are a number of openings $\frac{1}{2500}$ to $\frac{1}{200}$ inch in diameter. These are the Haversian canals, so called from the name of the person (Havers) who first detected them. The Haversian canals are each surrounded by a group of bony rings arranged concentrically or one outside another. In and between these rings will be noticed a number of small spider-like bodies (lacunæ) from which fine dark lines (canaliculi) radiate in all directions. If a similar section be made longitudinally, and inspected under a similar power, what in the first appeared as openings will now come into view as tubes traversing the bone tissue (fig. 282), and dividing and reuniting; the same dark lacunæ and canaliculi intervening between them.

The Haversian canals are so many channels for the accommodation of blood-vessels, by which the circulation in the bone is carried on.

The lacunæ are small corpuscles or spaces containing a mass of living protoplasm, and the fine lines proceeding from them are minute channels which communicate with each other and with the Haversian canals, into which some of them open. These channels serve the purpose of distributing nutritive matters for the support of the bone tissue.

CLASSIFICATION OF BONES

Bones are divided into three classes, distinguished as *long bones*, *flat bones*, and *irregular bones*.

Long bones make up the extremities, where they give support to the body, and act as so many levers in the function of locomotion. Each long bone is composed of a central portion or *shaft* and two extremities. The former is the more compact and narrow, the latter is chiefly formed out of spongy tissue, and is broad, and yields an articular surface covered with cartilage.

Flat bones, for the most part, enter into the formation of cavities containing important organs, as the cranium, the chest, and the pelvis.

Irregular bones are distinguished by their many angles and depressions, such as the vertebræ, and the bones of the knee and the hock-joint. They are mainly composed of cancellated tissue enclosed in a dense outer layer of compact structure.

To whatever class a bone may belong it will have upon it eminences and depressions. Some of these will be articular, and by uniting with other bones form joints, while others will be non-articular, and give attachment or lodgment to ligaments, muscles, or tendons.

GROWTH OF BONES

In the course of the growth of the fœtus much of the skeleton is laid down in a soft flexible substance termed cartilage or gristle, out of which bone is ultimately developed by a succession of changes, including the deposition of mineral matter into its structure. In long bones this process of ossification is first commenced in the centre of the *diaphysis* or shaft, from which it spreads to the extremities, where it is ultimately met by an ossifying centre from each. The two ends are termed *epiphyses*, and during the period when the animal is growing they may be, and sometimes are, broken away from the shaft by muscular contraction and other forms of violence. Where a considerable projection appears on a bone, as on the upper end of the femur, they are produced from separate centres of ossification and known as apophyses.

Growth in length takes place between the ossifying centre in the shaft and those of the extremities; in thickness it proceeds from the inner surface of the periosteum, which lays down bony matter layer upon layer.

Flat bones, such as those which enter into the formation of the cranium, the scapula or blade bone, &c., are developed between two membranes and not, as in long bones, from a pre-existing model of cartilage. The former is termed *intra-membranous* ossification, the latter *intra-cartilaginous*.

SKELETON

The skeleton is the bony framework which gives attachment to muscles, forms cavities for the safe lodgment of the organs essential to life, and gives general support to the body. When the bones are united by their proper ligaments the skeleton is said to be a *natural* one, but when they are held together by wire, catgut, and other foreign materials, it is termed an *artificial* skeleton.

The skeleton of the horse is made up of about 163 bones, which are united in various ways to form joints movable or fixed, according to the purpose of the part into which they enter.

The skeleton is divided into trunk and extremities. The trunk comprises the head and spinal column, the ribs, the sternum, and pelvis. The extremities are distinguished as the fore and hind, or the thoracic and pelvic.

VERTEBRAL COLUMN

The vertebral column consists of a long series of irregular-shaped bones termed vertebræ, united together in various ways to form a long undulating column commonly known as the "spine".

Vertebræ are divisible into *true* and *false*. The former are characterized by the presence of a certain group of parts, some of which are absent in the latter. Moreover, true vertebræ in health are always free and separate from each other, while false ones may become joined together by bony union. Examples of the latter are seen in the bones of the *sacrum* and those of the *coccyx* or tail.

Each of the several vertebræ, from the head backward as far as the commencement of the tail, forms a ring which, when the whole are brought together, constitutes the spinal canal in which is enclosed the spinal cord.

The vertebral column contains from 50 to 54 pieces, which for convenience of description are divided into four sections, viz.: the *cervical*, *dorsal*, *lumbar*, and *sacro-coccygeal*.

The first 7 bones are the cervical vertebræ or neck-bones; beyond these are 18 dorsal vertebræ or back-bones, behind which are sometimes 5 but mostly 6 lumbar or loin bones, and beyond these are 5 sacral bones, corresponding to the croup, and 14 to 18 coccygeal or tail bones.

For the most part the vertebræ composing these several regions bear more or less resemblance to each other, but possess some special differences by which bones of one region may be distinguished from those of another.

True Vertebræ are characterized by a number of bony prominences or *processes*, a central *canal* for the accommodation of the spinal cord, a solid discoidal mass or *body* and an *arch* (neural arch). The anatomical parts of a vertebra are shown in figs. 4 and 5, Plate XXXVIII.

A conspicuous exception to this formula is presented by the first cervical vertebra, which is a simple ring of bone with two broad sloping transverse processes and a small inferior spinous process (fig. 1, Plate XXXVIII).

The Processes.—The superior spinous processes of the neck are very short, those of the back and loins are long, especially in the region of the withers, where they increase in length from the first to the fifth and then diminish again backward (Plate XXXVII).

The inferior spinous processes are for the most part small, and in some of the bones only exist in a very rudimentary state.

The two transverse processes, right and left, consist of irregular bony

prominences varying in form and size in different parts. In all they serve for the attachment of muscles, in addition to which those of the dorsal vertebræ are also united to the ribs, with which they have a synovial articulation. In the neck an opening passes through the transverse processes of the first six vertebræ, while in the loins these processes are very long and flat, and some of them behind have synovial articulations by which they are joined together.

The oblique processes are situated on the anterior and posterior parts of the arch. They form joints with corresponding parts on the bones in front and behind them by broad synovial surfaces, the two anterior of which look upward and inward, while the two posterior look downward and outward.

The Body is the thick solid base on which the arch rests, and which forms the floor of the spinal canal. Its anterior extremity is round or convex, and fits into a corresponding hollow or concavity in the bone before it. Its posterior extremity is concave, and receives the rounded end of the vertebra which follows it. These convexities and concavities are much greater in the cervical vertebræ than in other regions, on account of which the neck is able to move with exceptional freedom in all directions. On either side, in front and behind, a small depression exists on the bodies of the dorsal vertebræ for the accommodation of the heads of the ribs, which fit in between them to form a synovial articulation.

The Neural Arch is formed by two plates of bone which spring from the upper surface of the body on either side, and unite above to form the spinal canal. In the anterior and posterior borders of the neural arch above the body of each vertebra are two notches which, with corresponding notches in the vertebræ before and behind it, form openings, termed the intervertebral foramina, through which the spinal nerves leave the spinal canal.

The False Vertebræ are those of the sacrum, the several pieces of which are firmly joined together by bony union, and the coccygeal bones, from which some of the parts above described are wanting or exist only in a rudimentary form.

PARTICULAR VERTEBRÆ

The first vertebra or **Atlas** (fig. 1, Plate XXXVIII), so described because in the human family it supports the head, differs in a striking manner from the typical vertebra, being a mere ring of bone, having two broad wings or transverse processes jutting out from the sides. In front it presents two deep concave surfaces, which articulate with corresponding

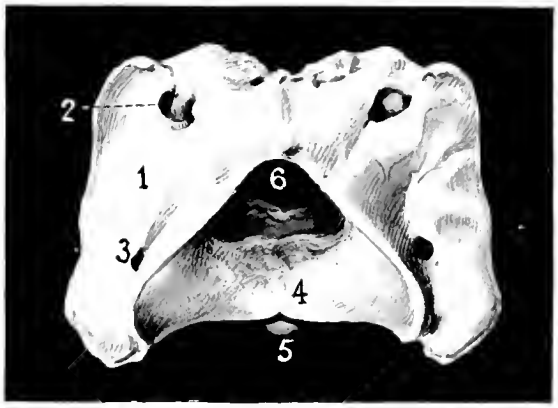


Fig. 1. ATLAS (supero-posterior surface)

1. Wing.
2. Supero-anterior foramen.
3. Postero-inferior foramen.
4. Surface for articulation with AXIS.
5. Inferior tubercle or inferior spinous surface.
6. Spinal canal.

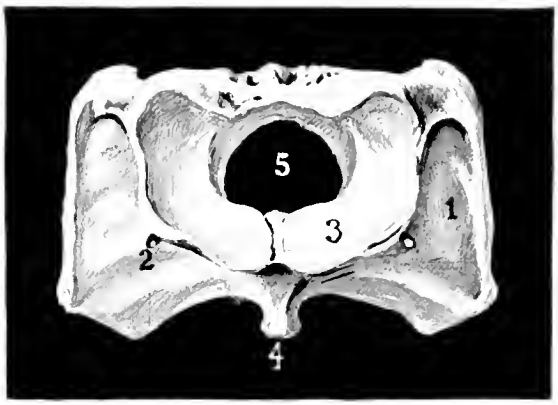


Fig. 2. ATLAS (antero-inferior surface)

1. Wing.
2. Postero-inferior foramen.
3. Facet for articulation with condyles of occiput.
4. Inferior tubercle or inferior spinous process.
5. Spinal canal.

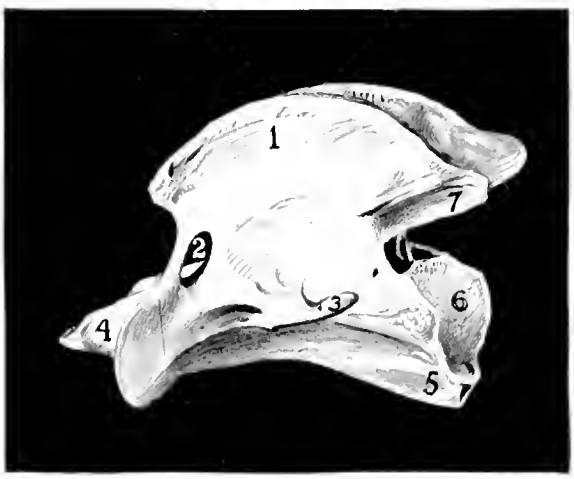


Fig. 3. AXIS (side view)

1. Superior spinous process.
2. Intervertebral foramen.
3. Transverse process.
4. Odontoid process.
5. Inferior spinous process.
6. Posterior articular face of body.
7. Oblique process.

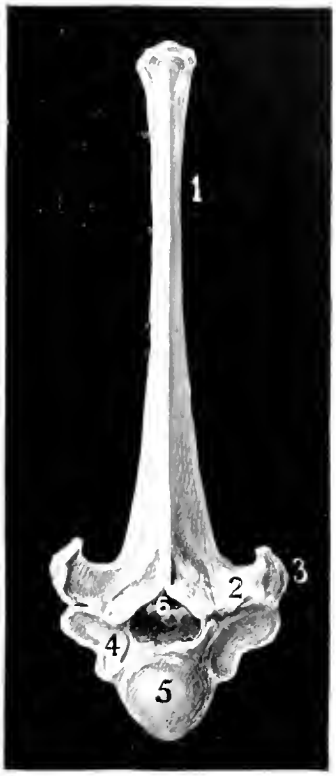


Fig. 4. DORSAL VERTEBRA (front view)

1. Superior spinous process. 2. Transverse process. 3. Articulation for tubercle of rib. 4. Articulation for head of rib. 5. Anterior articular face of body. 6. Spinal canal.

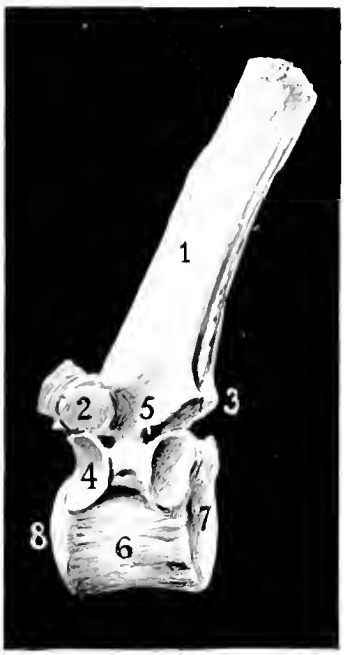


Fig. 5. DORSAL VERTEBRA (side view)

1. Superior spinous process. 2. Facet for articulation of tubercle of rib. 3. Posterior articular process. 4. Facet for articulation of head of rib. 5. Intervertebral notch. 6. Body. 7. Posterior articular surface of body. 8. Anterior articular surface of body.

convexities or condyles (occipital condyles) at the back of the head. It is by the peculiar construction of this joint that the free up-and-down movement of the head upon the neck is rendered possible.

Behind is a large single articular surface with which it is united to the second bone or axis. The spinal opening in this bone is of considerable size, in order to permit the extensive and varied movements of the head upon the neck without injury to the spinal cord.

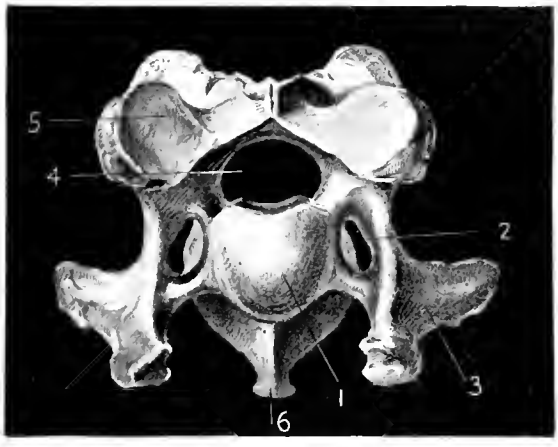


Fig. 283.—Cervical Vertebra

[1] Articular Head. [2] Vertebral Foramen. [3] Transverse Process. [4] Spinal Canal. [5] Anterior Articular Process. [6] Inferior Spinous Process.

The **Axis** (fig. 3, Plate XXXVIII) or second bone of the neck is so called because it serves as a pivot on which the head is moved from side to side. The pivot is provided by a process of bone (odontoid process) which proceeds from the anterior extremity of the body and passes into the ring of the atlas which is in front of it. This bone differs from the other cervical vertebræ, in the large size and strength of its superior spinous process, the small size of the transverse processes, and the presence of only two oblique processes, which are behind.

The remaining five cervical vertebræ are distinguished numerically as the 3rd, 4th, 5th, 6th, and 7th (fig. 283), and although each possesses some minor distinctive feature, it is not necessary to dwell upon them here.

Fig. 284.—Dorsal Vertebra (Front View)

[1] Superior Spinous Process. [2] Transverse Process. [3] Articulation for Tubercle of Rib. [4] Articulation for Head of Rib. [5] Anterior Articular Face of Body. [6] Spinal Canal.

The Dorsal Vertebræ (fig. 284) present a good deal in common. Some of them, however, are readily distinguishable from the others by the length of the superior spinous processes. This is especially the case with regard to the first eight bones. Of these the length increases to the fifth, and then gradually diminishes backward.

The Lumbar Vertebræ (fig. 285) are distinguished from those above described in the much greater length and width of their transverse pro-

cesses, which are directed horizontally outwards. The last two are much thicker and somewhat shorter than the rest, and are united to each other

Fig. 285.—Lumbar Vertebra

[1] Superior Spinous Process. [2] Anterior Oblique Process. [3] Transverse Process. [4] Anterior Articular Face of Body. [5] Spinal Canal.

by the borders of their transverse processes, and to the transverse process of the sacrum by synovial articulations.

The Sacrum (fig. 286) or rump bone, as we have already pointed

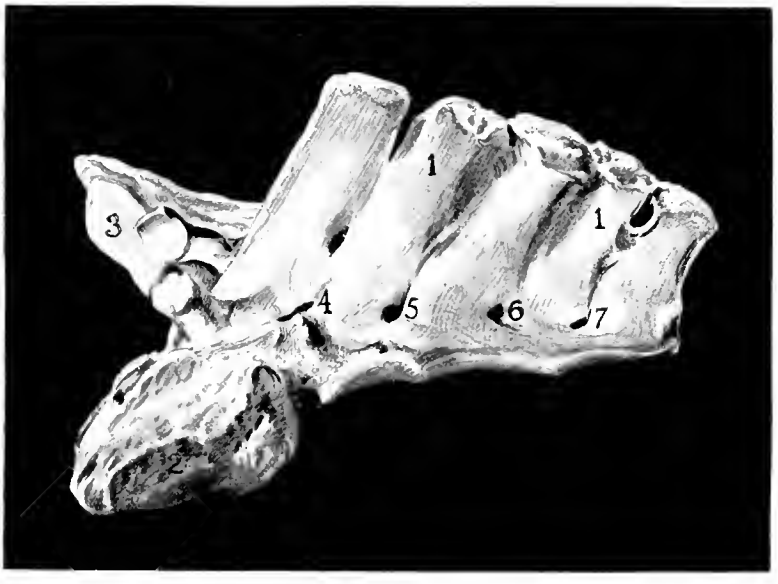


Fig. 286.—Sacrum (Side View)

[1 1] Superior Spinous Processes. [2] Transverse Process. [3] Articulation for Last Lumbar Vertebra. [4 5 6 7] Superior Sacral Foramina for the passage of the Superior Sacral Nerves.

out, is a large single triangular bone in the adult, resulting from the welding together of five vertebræ, which are separate in the fœtus. It

forms that part of the body termed the croup, and is fixed like a wedge between the dorsal spines of the ossa innominata or hip bones.

The Coccygeal Vertebræ, or tail-bones, are from fourteen to eighteen in number. The first three or four partake very much of the character of true vertebræ, being wanting only in the oblique processes. In the remainder of the tail-bones the proper vertebral characters gradually become more and more obscure until they altogether disappear.

Most of the bones of the spine present some peculiarity of form by which they may be distinguished one from another; but enough has been said to give the reader a general idea of their characters.

SKULL

The skull or bony framework of the head is situated at the anterior extremity of the vertebral column, from which it is suspended by ligaments and muscles, and on which it is capable of being freely moved in all directions. It forms a number of cavities for the lodgment of important organs, as the cranium, the orbit, and the mouth.

In the young animal it is made up of thirty-two pieces or separate bones, all of which, excepting the lower jaw and the hyoid or tongue bone, become united in the adult by ossification. Of the thirty-two bones, the following six are single:—

Occipital Bone.	Ethmoid Bone.	Inferior Maxillary Bone or Lower Jaw.
Sphenoid Bone.	Vomer.	Hyoid or Tongue Bone.

The rest are in pairs:—

Parietal Bones.	Anterior Maxillary Bones.
Frontal Bones.	Malar Bones.
Squamous Temporal Bones.	Lachrymal Bones.
Petrous Temporal Bones.	Palatine Bones.
Nasal Bones.	Pterygoid Bones.
Superior Maxillary Bones.	Turbinated Bones (two pairs).

The head is divided into the *cranium* and the *face*.

CRANIUM

As compared with the body, the cranium or brain-case of the horse is remarkable for its small size. Of the thirty-two bones forming the skull, fourteen are engaged in enclosing the cranium, of which four are single bones, and the rest pairs.

Occiput. — This bone is situated at the superior extremity of the cranium, and, as we have already pointed out, furnishes two large condyles, by which it articulates with the atlas, or first bone of the neck (15, fig. 289). Above, it forms the crest or prominence between the ears, while below it gives off a process (*basilar process*) which passes forward to assist in forming the base of the skull. Behind, it forms the superior boundary of the cranium, where it presents two rounded projections or condyles. Between these is a large opening (*foramen magnum*), through which the brain is connected with the spinal cord. On the outer side of the occipital condyles a bony projection (*styloid process*) is found. This, like other parts of the bone, affords attachment to important muscles.

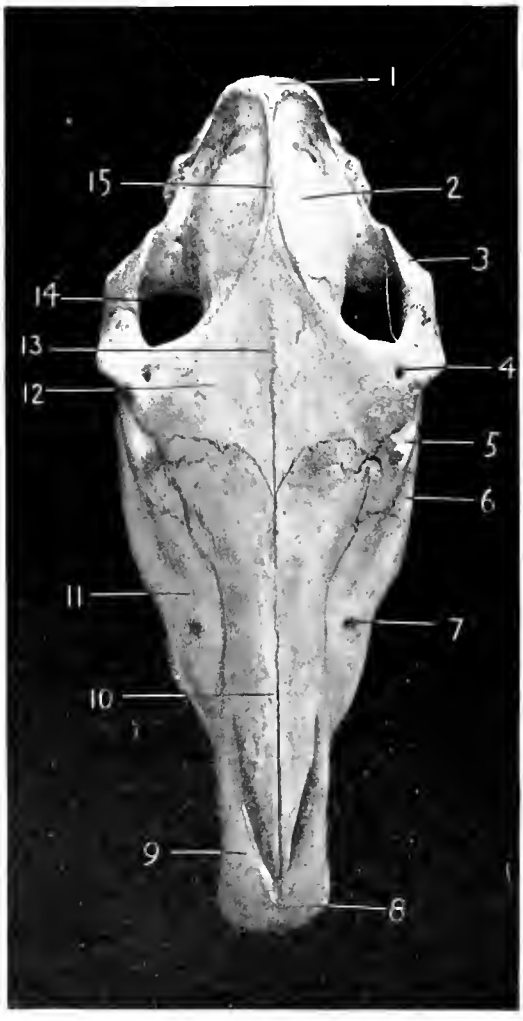


Fig. 287.—Skull (Front Aspect)

[1] Occipital Tuberosity. [2] Parietal Bone. [3] Squamous Temporal Bone. [4] Superior Orbital Foramen. [5] Lachrymal Bone. [6] Malar Bone. [7] Inferior Orbital Foramen. [8] Foramen Incisivum. [9] Anterior Maxillary Bone. [10] Nasal Suture. [11] Superior Maxillary Bone. [12] Frontal Bone. [13] Frontal Suture. [14] Temporal Fossa. [15] Sagittal Suture.

Parietal.—The parietal bones are two, situated immediately beneath the bone last described and above the frontal bones. They are united by the sagittal suture in the middle line of the cranium, and serve to form the roof of that cavity.

Temporal Bones. — These are four in number, two pairs, distinguished from each other as the *squamous* and the *petrous* temporal bones, the former having a shell-like structure, while the latter are of great density and hardness. The petrous temporal bones contain the organs of hearing.

Squamous Temporal.—These are two flattened portions of bone situated at, and forming the sides of, the brain cavity. From the outer part, near the middle, a long bony eminence proceeds in a downward direction to unite with the orbital process of the frontal bone above, and the

malar or cheek-bone below. This is the *zygomatic process*, on the under surface of which will be seen a concavity for the reception of the condyle of the lower jaw, the two together forming the inferior maxillary articulation or joint.

Petrous Temporal.—Two small hard irregular bones, but of considerable importance owing to their having within them the special organs of hearing. They are interposed between the occipital bones above, and the parietal and temporal bones below, and assist in forming the lateral walls of the cranium. They are the hardest bones in the skeleton, and from them project several bony processes. One, the *external auditory canal*, communicates with the middle ear. Another, the *styloid process*, is a long thin piece of bone projecting downward and forward, and behind this is a larger rounded protuberance, the *mastoid process*, which is hollowed out into a number of small compartments connected with the middle ear. Another small process serves for attachment of the tongue bone, and is known as the *hyoid process*.

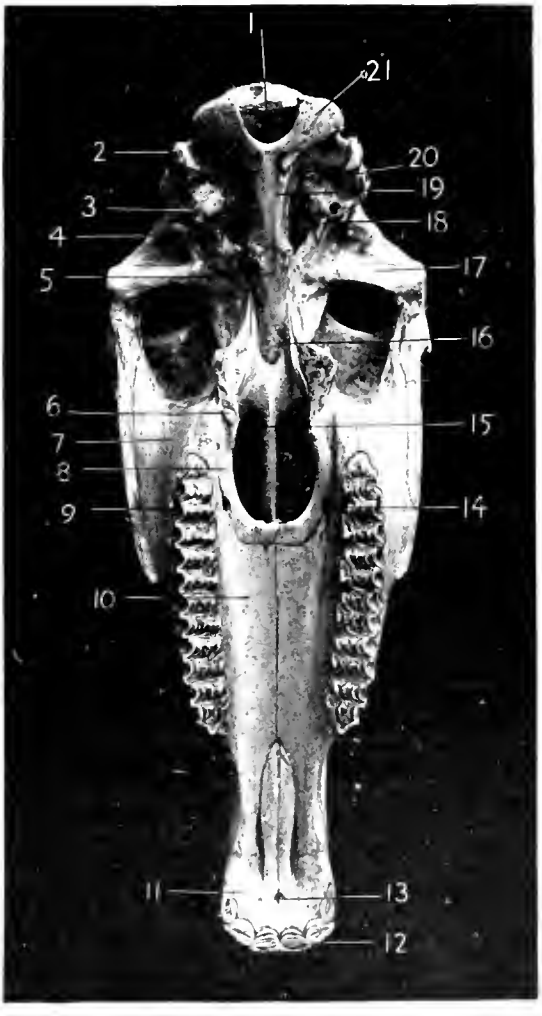


Fig. 288. Skull (Posterior Surface)

[1] Foramen Magnum. [2] Styloid Process of Occiput. [3] External Auditory Process. [4] Styloid Process of Petrous Temporal Bone. [5] Sphenoid Bone. [6] Pterygoid Process. [7] Superior Maxillary Bone. [8] Palatine Bone. [9] Molar Teeth. [10] Palatine Process of Superior Maxillary Bone. [11] Premaxillary Bone. [12] Incisor Teeth. [13] Foramen Incisivum. [14] Palato-maxillary Foramen. [15] Vomer. [16] Ethmoid Bone. [17] Temporal Condyle. [18] Foramen Lacerum Basis Cranii. [19] Basilar Process of Occiput. [20] Petrous Temporal Bone. [21] Occipital Condyle.

Sphenoid Bone. — This bone assists in forming the base of the cranium. It is situated immediately below the occipital bone, with which it articulates. Its middle part or body is somewhat thick, and from it proceed upward two flattened portions, or wings, and downward two narrower and more slender projections (*pterygoid processes*).

Ethmoid or Sieve Bone. — The ethmoid bone is situated in front of the sphenoid, and forms the lower part of the division separating the cranium from the face. It consists of two lateral halves, separated by a perpendicular plate (the lamina). Each half in front consists of a number of thin fragile plates of bone, rolled up into small scrolls (*ethmoidal cells*), and attached to the cribriform plates, *i.e.* two bony plates having a number of small holes in them, by which the olfactory nerves escape from the cranium into the nostrils. At the sides it throws up two wing-like processes, which articulate with the frontal bones.

Frontal Bones. — These bones form a portion of the inferior wall of the cranium, as well as that part of the face corresponding to the forehead. They are situated between the parietal bones above and the nasal and lachrymal bones below, and have union with several other bones of the cranium and face. Each of the frontal bones assists in forming an irregular cavity of considerable extent (*frontal sinus*), which contains air and communicates with the nostril. These frontal sinuses are lined by mucous membrane. They give lightness to the head, and in "nasal gleet" sometimes require to be opened in order to give exit to the pus which accumulates within them. They are very small in early life, but enlarge as age advances, and are separated one from the other by a bony partition.

BONES OF THE FACE

Nasal Bones.—These bones form the anterior part of the face below, and are situated beneath the frontal bones, and between the lachrymal and the superior and anterior maxillary bones. They are the slender bones commencing above by a broad extremity and ending below in a pointed process (*nasal peak*). They form the front boundary wall of the nasal cavities.

Superior Maxillary Bones. — The upper jaw-bones are situated on the side of the face, and join together by means of a flattened plate (palatine process) in the centre of the roof of the mouth, a large portion of which they form. They also form the floor and sides of the nostrils, and the sockets, or *alveoli*, into which the fangs of the upper grinders or "molar" teeth are implanted. Like the frontal bones, they are hollowed out into *sinuses*, which sometimes become diseased as the result of direct injury to the jaw, or to disease extending from the fangs of the teeth. In these cases they become filled with matter to which exit has to be given by an operation.

Anterior Maxillary Bones. — These bones are situated at the

lower part of the face, and carry the upper incisor teeth. They are joined together in front, and also by a thin flexible plate which forms the anterior part of the roof of the mouth and the floor of the nostrils. In the old animal they become inseparably bound together by ossific union.

Lachrymal Bone. — This is a small bone situated at the inner angle of the orbit, which it assists in forming. It has running through it a funnel-shaped cavity (*lachrymal fossa*), which gives lodgment to a small

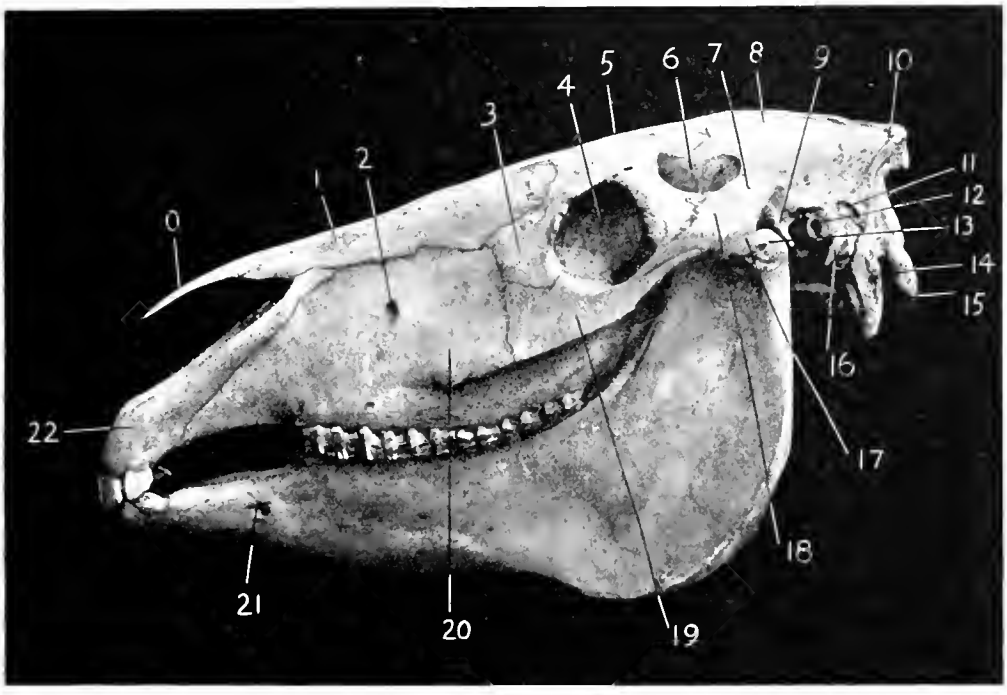


Fig. 289.—Skull (Side View)

[0] Nasal Peak. [1] Nasal Bone. [2] Inferior Orbital Foramen. [3] Lachrymal Bone. [4] Orbital Cavity. [5] Frontal Bone. [6] Temporal Fossa. [7] Zygomatic Arch. [8] Parietal Bone. [9] Supra-condyloid Process. [10] Occipital Tuberosity. [11] Petrous Temporal Bone. [12] External Auditory Hiatus. [13] Maxillary Condyle. [14] Styloid Process of Occipital Bone. [15] Occipital Condyle. [16] Styloid Process of Petrous Temporal Bone. [17] Temporo-maxillary Articulation. [18] Squamous Temporal Bone. [19] Malar Bone. [20] Superior Maxilla. [21] Mental Foramen. [22] Anterior Maxilla.

sac (*lachrymal sac*), and this is continuous with a long membranous canal (*lachrymal duct*), which conveys the tears from the eye into the nostrils.

Malar Bone. — This is placed at the outer and inferior part of the orbit, where it sends a branch backward and joins the temporal bone to form the *zygomatic arch*, and the socket for the lodgment of the eye and its muscles.

Palatine Bones. — The palatine bones are situated at the back part of the roof of the mouth, and form a narrow border to the posterior nares or opening between the nostrils and the throat.

Pterygoid Bones.—These are two small slender bones placed immediately above the palate bones.

On the outer side of each is a groove or pulley, through which a small tendon plays, belonging to the muscle (*tensor palati*) that tightens up the palate in the act of swallowing.

The Vomer.—A single bone running along the whole length of the floor of the nasal cavities, where it occupies a central position. Its anterior border is deeply grooved, and gives lodgment to a flat piece of cartilage

Fig. 290.—Lower Jaw

[1] Coronoid Process. [2] Condyle. [3] Molar Teeth. [4] Mental Foramen. [5] Incisor Teeth. [6] Surface for attachment of Masseter Muscle.

(*septum nasi*) by which the nasal passages are divided one from the other.

Turbinated Bones.—These are four in number, two situated in each nasal passage, where they are attached to the outer walls one above the other. They are long, thin, fragile plates of bone, folded upon themselves into rolls, which extend nearly from one extremity of the nose to the other. They are covered with mucous membrane, and afford a large surface for the distribution of the nerves of smell (*olfactory nerves*), and for the secretion of mucus.

Inferior Maxillary Bone or Lower Jaw.—This is a single bone composed of two flattened branches, which converge from above downward, and unite in front to form the body. It is the largest bone of

the face. It carries six molar teeth, or grinders, on each side, and six incisor teeth in front. In addition, it also gives lodgment to two canine teeth or tusks in the male. Above it forms a hinge joint on either side, where its rounded prominences or condyles are fitted to corresponding depressions in the temporal bones by the interposition of a disc of cartilage. In front of the condyles are two long, thin, and flattened bony prominences, the "coronoid processes", which give attachment to muscles of mastication. On the inner sides above, and on the outer sides below, are two openings communicating with a long canal, through which pass an artery and a nerve to supply the teeth with blood and sensation.

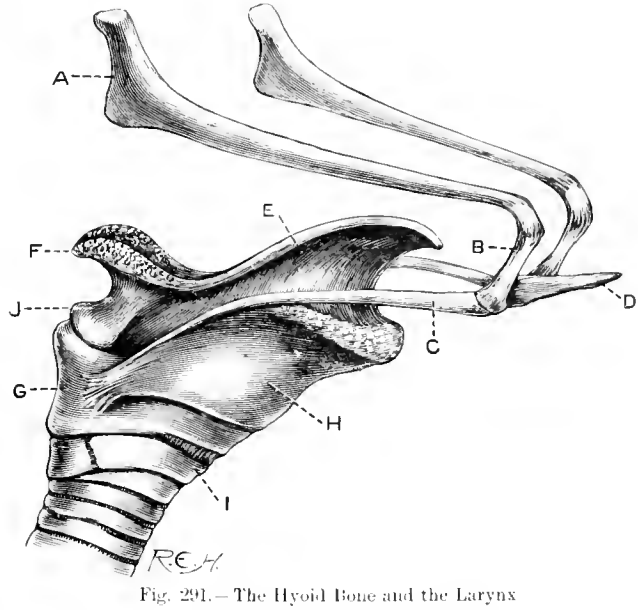


Fig. 291.— The Hyoid Bone and the Larynx

A, Superior or Long Cornu of Os Hyoides. B, Inferior or Short Cornu. C, Thyroid or Heel-like Process. D, Spur Process. E, Epiglottis. F, Glottis. G, Cricoid Cartilage. H, Thyroid Cartilage. I, First Ring of Trachea. J, Arytænoid Cartilage.

Os Hyoides or Tongue Bone. — This bone is situated in the region of the throat, and is composed of five distinct pieces. One is formed like a spur, having a short, pointed process projecting forward, and embedded in the root of the tongue, and the heel-like branches directed backwards to be connected with the larynx or upper part of the windpipe. The others, two flat slender pieces on either side (*superior* and *inferior cornua*), are united together and attached above to the petrous temporal bone at the base of the cranium by means of a short rod of cartilage. The several parts composing the bone are joined together by articulations, some of which form free-moving joints, to which the extreme mobility of the tongue is due.

THE THORAX OR CHEST

The bony framework of this cavity is formed by the dorsal vertebræ above, which we have already referred to, the sternum below, and the ribs which form the sides and part of the roof.

Sternum or Breast-Bone (fig. 292).—This is a long bone, suspended from the dorsal spine by the ribs, the first eight of which articulate with it. In early life it is made up of six distinct pieces, united by intervening

Fig. 292.—Sternum

[1] Carniform Cartilage. [2] Ensiform Cartilage or Xiphoid Appendage. [3] Inferior Border. [4 4 4] Cavities for articulation with lower extremities of Costal Cartilages.

cartilage or gristle. In front it is like the keel of a vessel, owing to the projection of a flattened piece of cartilage (*cariniform cartilage*) which curves upward and presents a sharpened border to the front, and below for about two-thirds of its length. The posterior extremity is continued

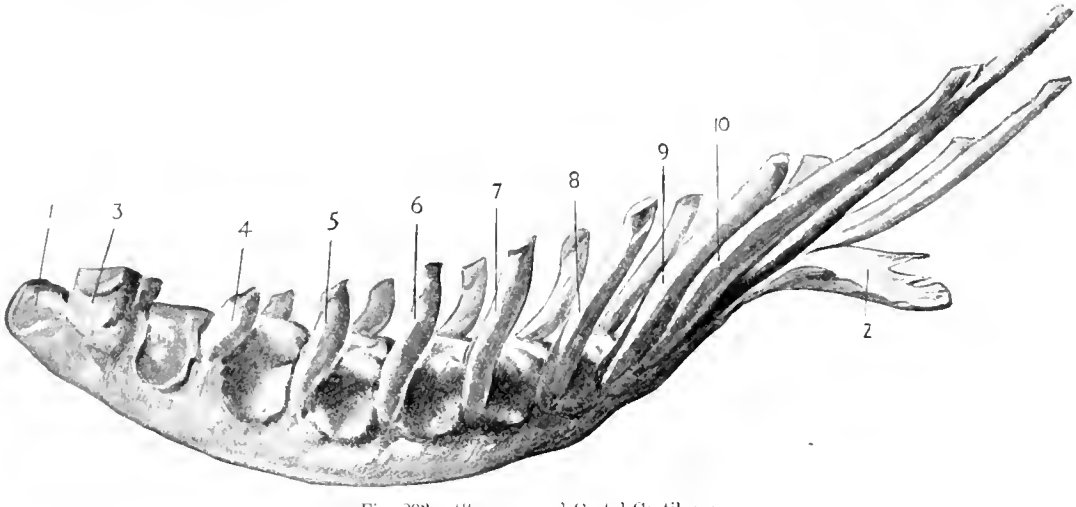


Fig. 293.—Sternum and Costal Cartilages

[1] Cariniform Cartilage. [2] Ensiform Cartilage. [3–10] Costal Cartilages.

backward by a flat piece of cartilage, called the *xiphoid* or *ensiform cartilage*, and along the superior part of each side of this bone are eight depressions, which receive the inferior ends of the cartilages of the true ribs to form so many synovial articulations or joints.

The Ribs (Plate XXXVII).—We have already pointed out that there are eighteen ribs on each side, distinguished numerically as the first, second, third, and so on. The first eight are attached to the sternum and designated true ribs. The remaining ten, having no such connection, are called false ribs. Although they are thus distinguished, they all possess certain common characteristics. They are long, flat, more or less curved or arched outward from the chest, and are, besides, somewhat twisted on themselves. They are all connected with the vertebræ above by two free-moving joints, and below they are attached to rods of cartilage (*costal cartilages*), through which the first eight become united by synovial articulations to the upper part of the side of the sternum, as already explained. Each rib possesses a head, a neck, and a tubercle at the superior extremity. The head fits into a hollow formed between the bodies of two vertebræ, where it is united by ligaments to form a free-moving joint. The tubercle forms another synovial articulation with the transverse process of the vertebra behind. The length of the ribs varies with the position they occupy. From the first to the ninth they increase in length, and then progressively they diminish to the last. Variation is also noticeable in the width, which increases from the first to the sixth or seventh, and then diminishes to the eighteenth.

Fig. 294.—Pelvis (Superior Aspect)

[1] Antero-inferior Spine of Ilium. [2] Supero-posterior Spine of Ilium. [3] Obturator Foramen. [4] Lateral Ischiatic Notch. [5] Tuberosity of Ischium. [6] Ischiatic Arch. [7] Symphysis Ischii. [8] Symphysis Pubis.

The outward curve they make increases from the first to the last, and gives rotundity to the body in proportion as it is great or otherwise.

Costal Cartilages.—These are cylindrical pieces of cartilage extending in a forward direction from the lower extremities of the ribs, which they serve to elongate. The first eight are united with the sternum, and

are the thicker and stronger. They increase in length from before backward to the eleventh, after which they become shorter.

The Pelvis (figs. 294, 295).—The bony pelvis or hip girdle consists of two portions, termed coxæ or ossa innominata, which, together with the sacrum and the front segments of the tail-bones, form the cavity of the pelvis.

The ossa innominata are flat, irregular bones, which, after forming the sides of the pelvic cavity, join together below to form its floor. In the fœtus each innominate bone consists of three pieces, termed the *ilium*, the *ischium*, and the *pubis*. The ilium, the largest of the three, is that portion which unites with the sacrum above, with the acetabulum or femoral joint below, and outwardly forms the "point of the hip". The ischium is that portion which, on leaving the hip-joint, which it assists in forming, passes backward to the point of the buttock, and inward to join its fellow on the opposite side, thus contributing to the floor of the pelvis, and to the formation of a large opening there—the *obturator foramen*.

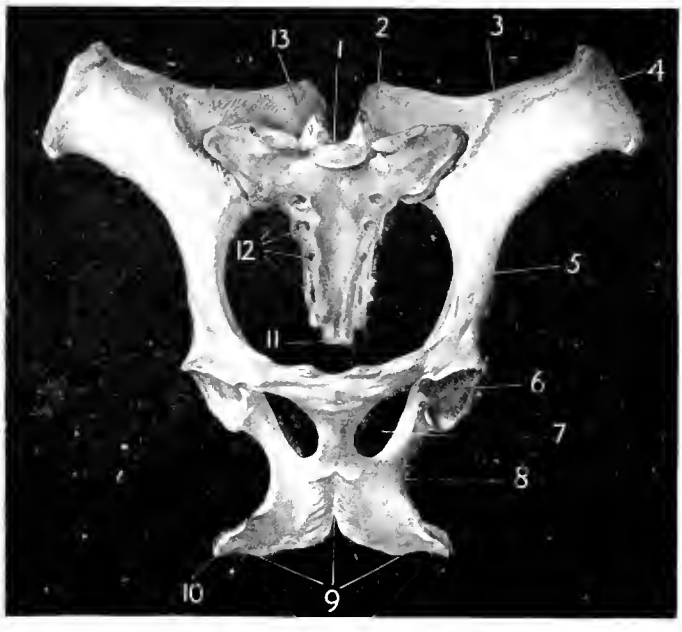


Fig. 295.—Pelvis and Sacrum (Inferior Aspect)

[1] Anterior Articular Body of Sacrum. [2] Posterior Spinous Process of Ilium. [3] Crista of Ilium. [4] Anterior Spinous Process of Ilium. [5] Neck of Ilium. [6] Acetabulum. [7] Obturator Foramen. [8] Lateral Ischiatic Notch. [9] Ischiatic Arch. [10] Tuberosity of Ischium. [11] Coccygeal Extremity of Sacrum. [12] Subsacral Foramina. [13] Anterior Articular Process of Sacrum.

The pubis is the smallest of the three bones entering into the formation of the coxa. It is situated in front of the floor of the pelvis, which, together with the foramen just referred to, it concurs in forming. With the ilium and ischium it also joins in making up the acetabulum or cup-like cavity into which the head of the femur fits to form the hip-joint.

The two pubic bones unite on the floor of the pelvis to form a seam, or, as it is termed, the *symphysis pubis*.

The cavity of the pelvis is much larger at the front or *inlet* than at

the *outlet* behind. The pelvic cavity of the mare is larger than that of the horse in every direction, but especially from side to side. The floor of the female pelvis is distinctly wider than that of the male animal.

THE FORE LIMB

The fore extremity is made up of twenty bones: the scapula, humerus, radius, and ulna above the knee; the scaphoid, lunar, cuneiform, pisiform, trapezoid, os magnum, unciform in the knee; and the large and two small metacarpal bones, two sesamoid bones, the os suffraginis, os coronæ, os naviculare, and os pedis below the knee.

Fig. 296.—Scapula (Outer Surface)

1, 1 Spine of the Scapula. [2] Coracoid Process. [3] Glenoid Cavity for Articulation of Humerus. [4] Dorsal Angle. [5] Cervical Angle. [6] Cartilage of Prolongation.

Scapula (figs. 296, 297).—This is the uppermost bone of the fore limb, a flat triangular segment placed on the side of the chest, where it takes an oblique direction downward and forward. Its base is turned upward, and its apex concurs with the humerus to form the shoulder-joint. A broad flat piece of cartilage is attached to its upper border, and gives increased length to the bone, hence it is termed *cartilage of prolongation*, or scapular cartilage. The scapula has three angles: 1, cervical, nearest the neck; 2, dorsal, nearest the back; 3, humeral, at the point of the shoulder. The last presents a shallow oval cavity, which receives the rounded head of the humerus to form the shoulder-joint. Immediately above it, in front, is a large rough curved offshoot of bone, the *coracoid process*, which gives attachment to important muscles.

The outer surface of the bone is divided into two unequal parts by a bony ridge or *spine*. This bone is united with the trunk by muscles only. It has no synovial articulation or joint connection as in the hind limb.

Humerus (figs. 298, 299).—The humerus, or arm-bone, is a bone of great thickness and density, and is situated between the scapula or blade-bone above and the radius and the ulna below. Externally the body of the bone is deeply grooved by the *furrow of torsion*, and presents at about its upper third a somewhat bold pointed projection, the *external tuberosity*. On the internal surface it presents a rounded prominence, the *internal tuberosity*, into which important muscles gain insertion.

Fig. 297.—Scapula (Inner Surface)

[1] Coracoid Process. [2] Glenoid Cavity. [3] Cartilage of Prolongation.

Fig. 298.—Humerus (Front Aspect)

[1] Bicipital Groove. [2] Small Trochanter. [3] Great Trochanter. [4] External Tuberosity. [5] Shaft with Furrow of Torsion. [6] Epitrochlea or External Condyle. [7] Supra-condyloid Fossa. [8] Epicondyle or Internal Condyle

On the upper extremity are the broad rounded head and several bony prominences. The former, situated behind, is coated with cartilage, and articulates with the *glenoid cavity* of the scapula or blade-bone to form the shoulder-joint. The latter comprise a double projection of bone on the outer side, termed the *great trochanter*. On the inner side is the *small trochanter* or tubercle, and between them a prominence which divides the upper front portion of the humerus into two grooves (*bicipital groove*). The

grooves and intervening tubercle are covered with fibro-cartilage, and over them plays, pulley-like, the broad tendon of the flexor brachii muscle, between which and the bone there is a synovial membrane.

Fig. 299.—Humerus (Outer Aspect)

[1] Great Trochanter. [2] Deltoid Tuberosity. [3] External Tuberosity. [4] Epitrochlea. [5] Epicondyle. [6] Supra-condyloid Fossa. [7] Shaft of Bone with the Furrow of Torsion. 8. Articular Surface or Head.

The lower extremity is smaller than the upper, and in front presents two unequal rounded portions separated by a superficial groove. These are the internal and external condyles. Behind is a deep pit (*supra-condyloid fossa*), which separates two prominent ridges from each other, and receives into it a pointed process (*peak*) on the elbow when the joint is in extreme extension.

Fig. 300.—The Forearm: Radius and Ulna

[1] Ulna. [2] Point of Ulna. [3] Beak of Ulna. [4] Radio-ulnar Arch. [5] Radio-ulnar Articulation. [6] Bicipital Tuberosity. [7] Shaft or Body of Radius. [8] Radio-carpal Articulation.

FOREARM

Two bones, the *radius* and the *ulna*, which in early life are separate, but in the adult are ossified together, constitute this region.

Radius (fig. 300).—This is the longest bone in the fore limb, and

extends from the humerus above to the knee below. Its superior extremity is divided into two concavities by a small ridge, and corresponds with the two convexities and the dividing furrow observed on the lower extremity of the humerus, with which it articulates to form the elbow-joint. Behind, towards the outer side, it presents a long roughened surface, where it forms a bony union with the ulna.

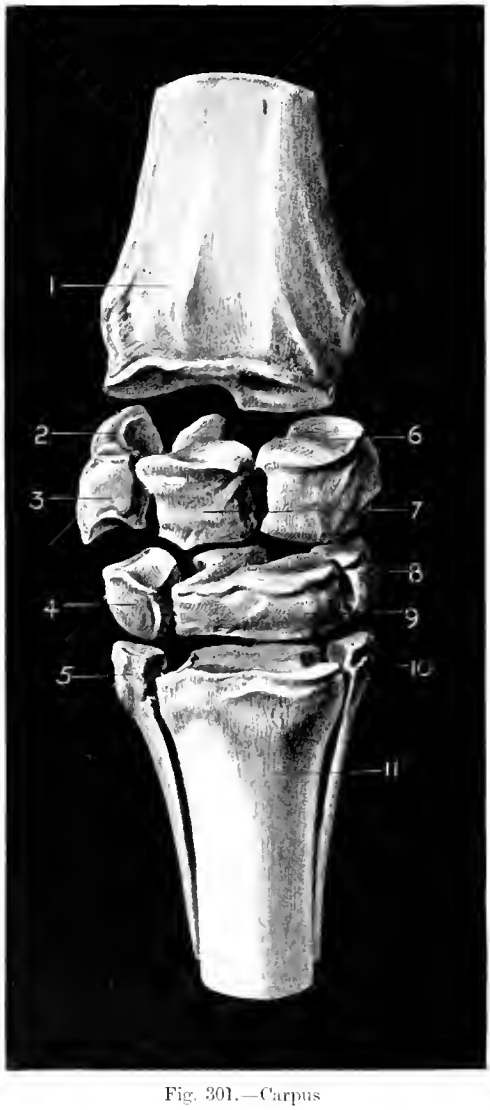


Fig. 301.—Carpus

[1] Radius. [2] Pisiform. [3] Cuneiform. [4] Uniform. [5] Outer Small Metacarpal Bone. [6] Scaphoid. [7] Lunar. [8] Trapezoid. [9] Os Magnum. [10] Inner Small Metacarpal Bone. [11] Large Metacarpal Bone.

The lower extremity is somewhat irregular, and articulates with the four bones comprising the upper row of the knee. In front there are three grooves over which three tendons play in passing down the limb to their points of insertion. Each tendon is supplied with a synovial membrane to facilitate its movements over the bone during flexion and extension of the knee.

Ulna (fig. 300).—The ulna is a long tapering bone, united by ossification to the outer and posterior surface of the radius. Its superior extremity is of considerable length and thickness, and projects from the head of the radius in an upward and backward direction. This is the elbow or *olecranon process*. In front it presents a smooth surface, which articulates with the groove between the condyles of the humerus, and also a hooked projection forward termed the *beak*.

CARPUS OR KNEE

This (fig. 301) is the analogue of the wrist of man. It is made up of seven, sometimes eight, small irregular bones arranged in two rows of three each, one resting upon the other, with the seventh bone (pisiform) situated at the posterior and outer part of the upper row.

The bones of the upper row, enumerating them from within outward, are the scaphoid, lunar, cuneiform, and the pisiform behind; those of the lower row are the trapezoid, magnum, and unciform. Sometimes a fourth, termed the trapezium, is found at the inner and posterior part of the lower row.

All these bones are united by short strong ligaments. At their several points of contact they are covered with articular cartilage or gristle, and enclosed in a synovial capsule. Altogether the knee is admirably adapted, by its many parts, to diffuse and disperse concussion, and at the same time for the performance of that high and free action so much admired by connoisseurs.

METACARPAL BONES

These are three in number, and are distinguished as the large metacarpal bone, which occupies the centre, and two smaller ones at the sides.

Os Metacarpi Magnum (fig. 303), or large metacarpal, or canon bone, extends from the knee to the fetlock joint, which it assists in forming. It is rounded in front, flattened behind, and very dense and strong throughout. Its superior extremity articulates with the lower row of knee bones, and in front, below the articulation, towards the inner

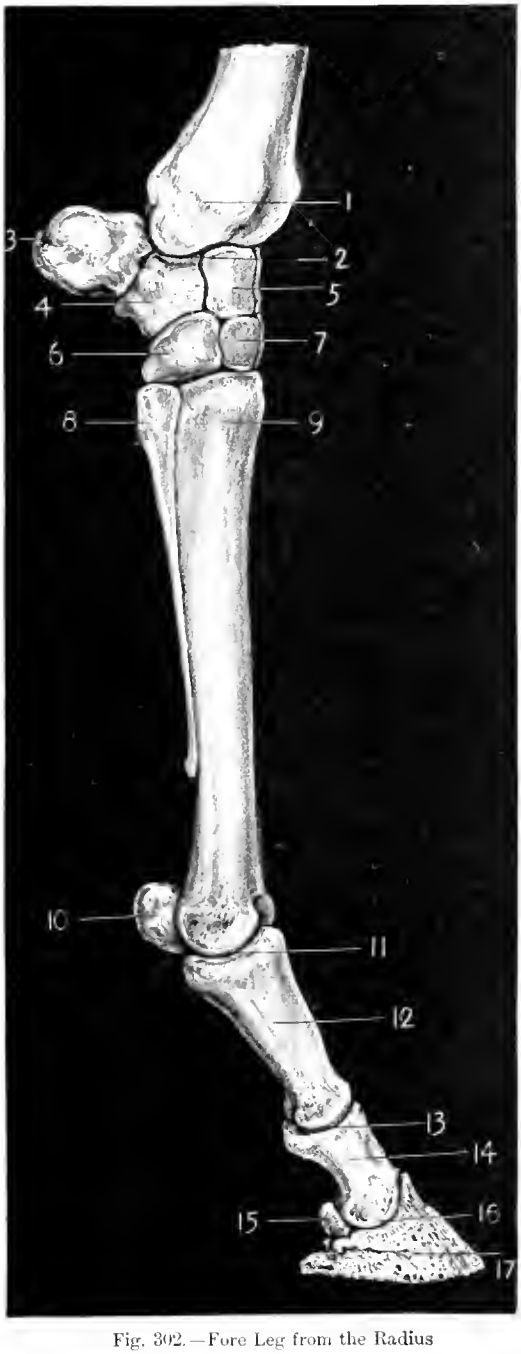


Fig. 302.—Fore Leg from the Radius

[1] Radius. [2] Radio-carpal Joint. [3] Pisiform. [4] Cuneiform. [5] Lunar. [6] Unciform. [7] Os Magnum. [8] Small Metacarpal Bone. [9] Large Metacarpal Bone. [10] Sesamoid Bone. [11] Fetlock Joint. [12] Suffraginis or First Phalanx. [13] Superior Pastern Joint. [14] Os Coronæ or Second Phalanx. [15] Navicular Bone. [16] Pedal Joint. [17] Os Pedis or Third Phalanx.

side, is a roughened prominence into which the tendon of its extensor muscle is inserted. At the back part of the upper end there is a roughened patch for the attachment of the suspensory and check ligaments. The lower extremity is rounded from before to behind, and divided by a prominent ridge into two nearly equal parts or condyles. The whole of this end is covered with cartilage, and articulates with a corresponding surface formed by the upper extremity of the os suffraginis, or large pastern bone, and the two small sesamoid bones behind.

Fig. 303.—Metacarpal Bones (Posterior View)

[1] Outer Small Metacarpal Bone. [2] Inner Small Metacarpal Bone. [3] Large Metacarpal Bone. [4] Nutritive Foramen. [5] Articular Condyles. [6] Intervening Ridge.

Os Suffraginis, Large Pastern, or First Phalanx (fig. 304).—The large pastern is a short stout bone placed between the small pastern below and the fetlock joint above. Its superior extremity is larger than the inferior, and presents two shallow depressions separated by a groove, into which the central ridge and two condyles, already spoken of as existing on the lower end of the canon, are fitted to form a joint of considerable extent of motion. The lower extremity is small, and divided by a superficial groove into two condyles.

Fig. 304.—Os Suffraginis or Large Pastern Bone

Sesamoid Bones (10, fig. 302).—These are two small floating bones situated behind the inferior extremity of the canon. They are somewhat triangular in form, with their bases directed downward, and are closely united one to the other. In front they are covered with cartilage, and articulate with the condyles of the canon bone, thus forming part of the

fetlock joint. Behind they are covered with fibro-cartilage, and by apposition form a groove over which the great flexor tendon of the foot plays like a rope over a pulley. On the outer sides, from the apex downward, a roughened groove gives attachment to the two branches of the suspensory ligament. The under surface of the base is also roughened, and from it proceed short strong ligaments (*inferior sesamoid*), which attach the bones to the posterior surface of the large and small pasterns.

Fig. 305.—Os Coronæ and Os Naviculare (Anterior Aspect)

Os Coronæ (fig. 305), small pastern, or second phalanx, is a short bone placed between the large pastern and the os pedis, or foot-bone. One-half of it is enclosed by the hoof, and the rest forms the region of the coronet. Its upper extremity presents two shallow depressions, with which the two condyles of the lower end of the large pastern articulate. The lower end, like that of the suffraginis, is divided by a shallow groove into two condyles, by which the bone articulates with the os pedis. The tendon of the extensor pedis muscle is attached to the anterior surface, and that of the flexor pedis perforatus to the inner and outer part of the superior border behind. At the upper and posterior part it is flattened and covered by fibro-cartilage, thus forming a smooth surface over which the tendon of the flexor perforans freely plays in its course towards the foot-bone.

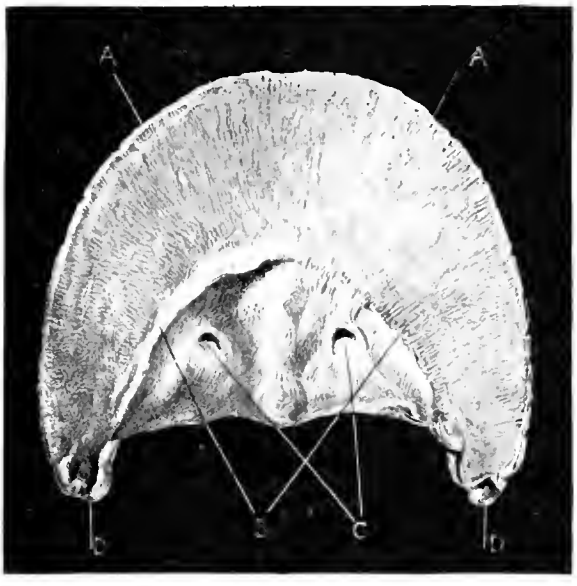


Fig. 306.—Os Pedis (Plantar Aspect)

A, A Inferior Border. B Semilunar Crest. C Plantar Foramina. D, D Retrossal Processes.

Os Pedis (figs 306, 307), coffin-bone, or third phalanx. The coffin-bone is contained in the hoof, of the shape of which it in a large measure partakes. It is a porous bone, having a number of holes in its front and sides for the passage of blood-

vessels, and is besides generally roughened for the attachment of the sensitive laminæ. A pointed process (*coronal process*) projects upward from the superior border in front, which affords attachment for the tendon of the extensor pedis muscle.

The under surface is concave, and presents (1) a crescentic ridge (*semi-lunar crest*) to which the tendon of the flexor pedis is attached; (2) behind this two considerable openings (*plantar foramina*), through which pass the plantar arteries and nerves; (3) still farther back a roughened surface, to which the inferior ligament of the navicular bone is connected. The upper surface is divided by a slight ridge into two shallow cavities, with which the lower extremity of the coronet bone articulates. At the posterior border of this surface a narrow, smooth, transverse space is provided for the articulation of the navicular bone with the foot-bone. Projecting backward from the inferior border behind are two bony processes, one on either side, termed *alæ*, or wings.

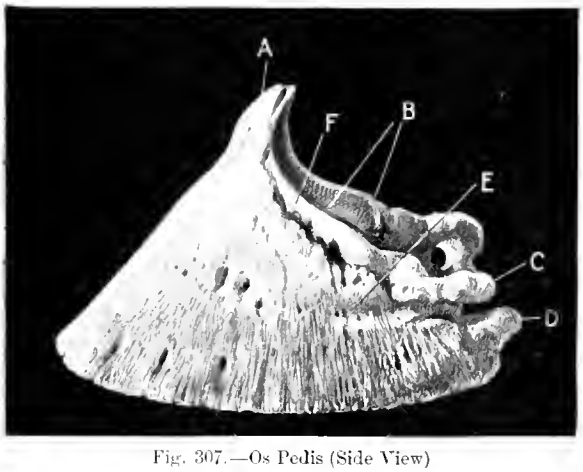


Fig. 307.—Os Pedis (Side View)

A Coronal Process. B Superior Border. C, D Basilar and Retrossal Processes, forming one of the alæ or wings. E Preplantar Fissure. F Facet for Insertion of the Extensor Pedis.

Os Naviculare or Shuttle Bone (fig. 305).—The navicular bone is a small flattened bone, broad in the middle and tapering towards each extremity. It is situated in the hoof, below the os coronæ and behind the os pedis, with both of which it articulates to form the coffin-joint. The great flexor tendon passes over its under surface, and between the two a synovial membrane exists to lubricate the surfaces of contact and facilitate movement. The anterior border articulates with the foot-bone, as already explained, and is connected below with the inferior navicular ligament. The posterior border affords attachment to the posterior navicular ligament. To the pointed extremities are attached lateral ligaments which unite the bone with the os pedis, the lateral cartilages, and the coronet bone.

The navicular bone is the seat of that very common ailment, navicular disease.

BONES OF THE HIND LIMB

The bones comprised in this region are the femur or thigh-bone, the patella or knee-cap, and the tibia and fibula. Then come the bones of the hock, the astragalus, calcis, cuneiform magnum, cuneiform medium, cuneiform parvum, and cuboid. The bones below the hock are the same as those already described in speaking of the fore extremity—the three metatarsal, suffraginis, two sesamoid, coronæ, pedis, and naviculare.

Fig. 308.—Os Femoris (Anterior Aspect)

[1] Head. [2] Internal Trochanter. [3 4] Tuberosities for Ligamentous Insertion. [5] Internal and External Trochlea. [6] Trochanter Minor Externus. [7] Great Trochanter.

Os Femoris or Thigh-Bone (figs. 308, 309). — This is a large, thick, strong bone, extending obliquely downward and forward from the hip-joint above to the stifle-joint below. The shaft presents a number of roughened places for the attachment of muscles. For the same purpose there are also several bony prominences and ridges, notably the *trochanter minor externus* on the upper third of the outer surface, the *trochanter minor internus* near the upper third of the inner surface.

The superior extremity is formed by the head, a rounded projection which fits into the acetabulum or cup in the innominate bone to form the hip-joint, and on the outer side of this a considerable eminence (*trochanter major*) for the attachment of some of the large muscles of the croup. Behind and below the trochanter major a somewhat deep cavity exists, called the *trochanteric fossa*, into which some smaller muscles are inserted.

The lower extremity presents four large prominences—two behind, the condyles, which are separated by a deep notch (*inter-condyloid fossa*), and two in front, the *trochlea*, with which the patella articulates. Above the

outer condyle behind is a deep depression termed the *supra-condyloid fossa.*

Patella (fig. 310).—This is a small irregular bone analogous to the knee-cap of man, and in the horse frequently becomes displaced. Behind it is covered with articular cartilage, and comes into contact with the trochlea of the femur, over which it plays in pulley-like fashion as a part of the stifle-joint.

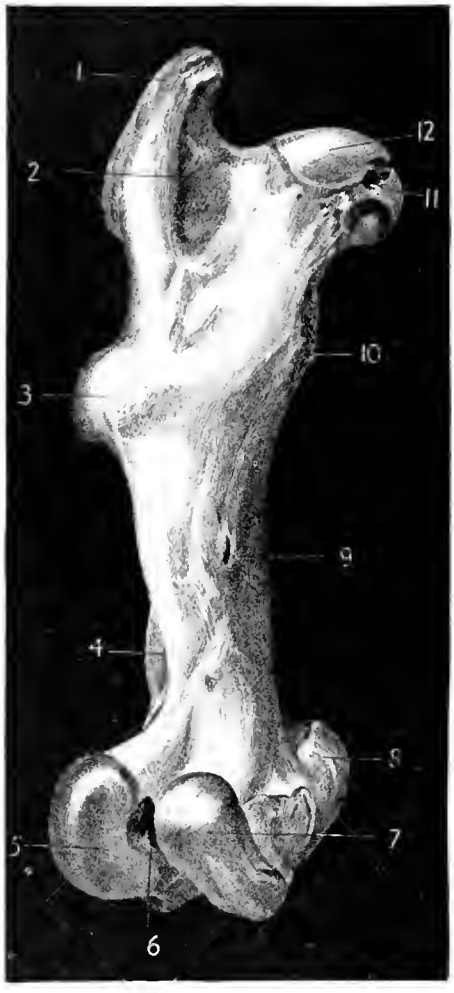


Fig. 309.—Os Femoris (Posterior Aspect)

[1] Great Trochanter. [2] Trochanteric Fossa. [3] Trochanter Minor Externus. [4] Supra-condyloid Fossa. [5] External Condyle. [6] Inter-condyloid Fossa. [7] Internal Condyle. [8] Internal Trochlea. [9] Nutritive Foramen. [10] Internal Trochanter. [11] Fossa for attachment of Ligamentum Teres. [12] Head of Femur.

Tibia or Second Thigh (fig. 311).—A long bone extending from the femur to the hock joint. It is broad above and narrow below. The superior extremity articulates with the condyles of the femur, and is divided into two lateral articular portions by a conical projection (*tibial spine*). In front, and extending for some distance down the bone, is a projecting ridge, inclining somewhat outward; this is known as

Fig. 310.—Patella (Superior and Posterior Face)

[1] Superior Face. [2] Articular Face. [3] External Border.

the "tibial crest". On the outer side of the head of this bone above, a small smooth space is noticed for articulation with the fibula.

The lower extremity of the bone, smaller than the upper, presents two deep grooves and three prominent ridges which are covered with cartilage and articulate with the astragalus to form the "true hock joint".

The inner and outer ridge each bears a projection distinguished as the internal and external *malleolus* of the tibia. The former is very prominent, so much so, sometimes, as to give the inner and upper part of the hock an abnormal appearance. These projections afford attachment for strong connecting ligaments uniting the bones of the hock joint.

The articular grooves, which they assist in forming, take an oblique direction from behind outward and forward.

The Fibula (3, fig. 311) is a long slender bone connected with the outer side of the tibia, with the head of which it unites by a small synovial articulation. It is broad above and tapers downwards to the lower third of the femur, where it terminates in a pointed extremity.

Fig. 311.—Tibia (Posterior Aspect)

[1] Spine of Tibia. [2] Articulation of Fibula. [3] Fibula. [4] External Malleolus. [5] Internal Malleolus. [6] Shaft showing Bony Ridges for Muscular Attachment.

THE TARSUS OR HOCK

This joint (fig. 312) is composed of six bones, viz., the calcis, astragalus, cuboid, cuneiform magnum, cuneiform medium, and cuneiform parvum.

The Calcis is situated at the posterior and outer part of the hock, of which it forms the "point", and gives attachment to the tendons of important muscles as well as to powerful ligaments. It articulates in front with the astragalus and below with the cuboid bone and the cuneiform magnum, on which it rests.

Astragalus or Knuckle-Bone.—This is the largest bone in the hock. It is placed in front of the calcis, and from it project forward two pulley-like ridges separated by a deep groove. These ridges are received into two corresponding grooves already referred to as existing on the inferior extremity of the tibia, and the central ridge on the last-named part fits into the groove separating those on the astragalus. Together these two bones form the true hock joint, to which the movements of flexion and extension of the limb are for the most part due. The astragalus rests upon the cuneiform magnum, with which it forms a flattened gliding-joint of very limited movement. Behind, it articulates with the calcis.

The Cuboid is a small irregularly-shaped bone situated on the outer and back part of the hock, having the calcis above it and the large and outer small metacarpal bones below. Inwardly, it articulates with the cuneiform magnum and the cuneiform medium.

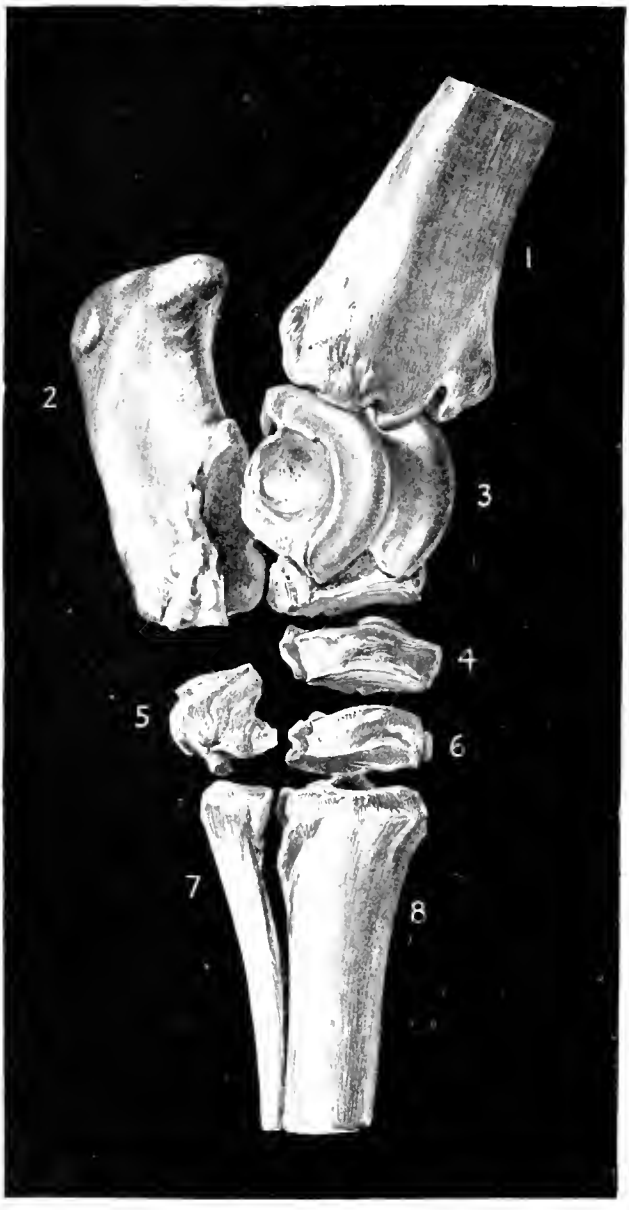


Fig. 312.—Bones of the Hock separated

[1] Tibia. [2] Os Calcis. [3] Astragalus. [4] Cuneiform Magnum. [5] Cuboid. [6] Cuneiform Medium. [7] Small Metatarsal Bone. [8] Large Metatarsal Bone.

The Cuneiform Magnum is a flat bone covered on its two surfaces with cartilage. It occupies a position between the astragalus above and the cuneiform medium below, and articulates besides with the cuboid, the calcis, and the cuneiform parvum.

The Cuneiform Medium is a triangular bone, and, like the magnum, presents two flattened surfaces for articulation with the magnum above, and the large metacarpal or canon-bone below. By smaller articulations it is also connected with the cuboid and the cuneiform parvum.

The Cuneiform Parvum, the smallest bone in the hock, is situated at the inner and inferior part of the joint, inclining backwards, where it articulates with the large and inner small metatarsal bones below, the magnum above, and the medium in front. The outer surface of this bone presents a smooth surface over which one of the tendinous branches of the flexor metatarsi plays in a synovial sheath.

Except in very unimportant particulars the bones below the hock resemble those below the knee, and do not, therefore, require special description.

DISEASES OF BONES

RING-BONE

A ring-bone is an enlargement extending over the front, and sometimes also over the back, of the pastern. It consists of a diffused bony excrescence growing out of or upon the large or small pastern bone, or both. When affecting the former it is described as high ring-bone (fig. 314), when the latter, as low ring-bone (fig. 313). It is common to all classes of horses, but more especially prevalent in cart-horses and thoroughbreds.

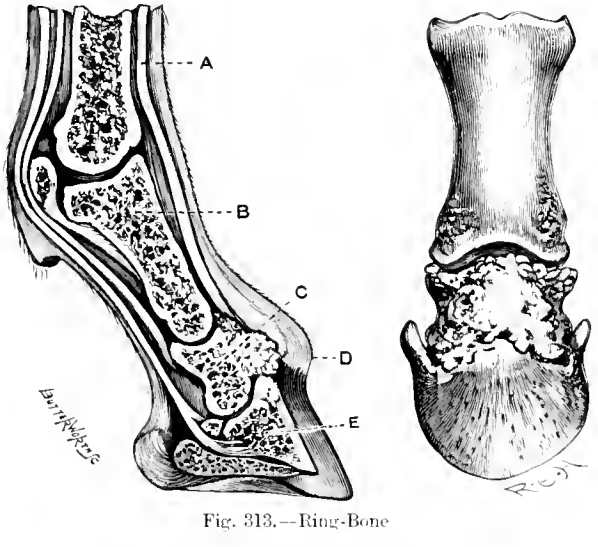


Fig. 313.—Ring-Bone

A, Extensor Pedis Tendon. B, Os Suffraginis or First Phalanx. C, Os Coronæ. D, Ring-bone. E, Os Pedis.

Fig. 314.—"High" Ring-Bone

Causes.—Horses with upright pasterns, and animals with pasterns of undue length, are specially predisposed to it. The exciting causes are chiefly blows, concussion, and sprains to the joints. Fracture of the pastern is invariably followed by ring-bone in the form of a reparative callus. It is also induced by the too early and severe work imposed on young, undeveloped animals, and especially when attended with bad shoeing, as where the heels are thrown up too high and an upright position given to the limb.

Symptoms.—A hard, unyielding enlargement, more or less prominent and extensive, is the characteristic indication of the disease. It passes across the front of one or the other of the pastern bones, and sometimes

encroaches on the posterior surface. The degree and character of the lameness will vary with the position of the growth. When situated on the small pastern, within the hoof, the lameness is very considerable, and the foot is brought to the ground with the bearing full on the heel. If it be situated behind, the fetlock joint is partially flexed and the weight is thrown on the toe. In other situations the action is not so conspicuously altered, but in all there is more or less severe lameness, with swelling, heat, and tenderness of the part.

Treatment.—To subdue existing inflammation should be our first aim. In this connection a dose of physic, with perfect rest, and the application of hot fomentations and bandaging, must be resorted to; after which a repetition of blisters, or the application of the actual cautery to the pastern, will be required to check further growth of the excrescence and to effect its reduction. A long rest is often needed before pain and lameness are removed, and in many instances this desired result is never attained.

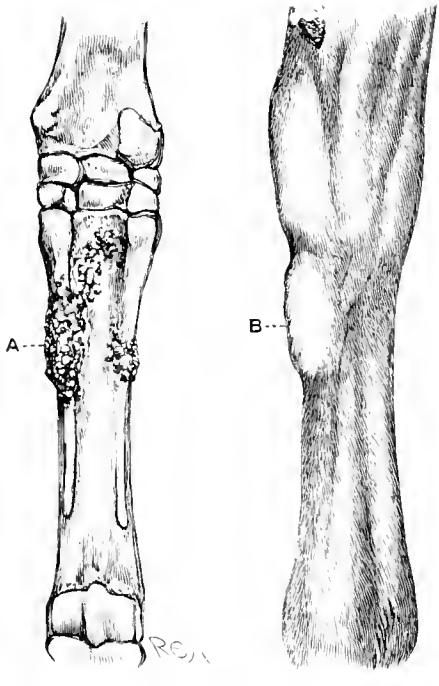


Fig. 315.—Splint

A, Exposed Splint. B, Splint covered by Skin.

SPLINT

Splint (fig. 315) is a bony excrescence situated on or near the small splint bones, and is often the means of permanently uniting the latter to the canon. Not fewer than 90 per cent of our light horses suffer from this ailment, but a large proportion of this number acquire it without suffering any inconvenience. Splints may be situated on the inner or the outer part of the limb, but in the great majority of cases they occupy the first-named position. Some are placed well forward, while others are situated quite at the back of the leg. In the former position they are not of much importance, but in the latter they usually prove troublesome, and provoke most acute and lasting lameness by encroaching upon and irritating the ligaments and tendons there situated. These growths assume a variety of forms. Sometimes they are very prominent and project from a narrow base, at others they are quite flat and diffused, and consequently with difficulty recognized. There may be only one large one, or several smaller ones may exist, placed one below another along the course of the

splint-bone. When involving the knee, splints interfere with the flexion, or bending, of the joint, and may occasion permanent disablement.

The degree of lameness is not always proportionate to the size of the growth. Splints sometimes develop to a large size without occasioning trouble, while very small ones, when backwardly placed, may give rise to the most acute and abiding lameness.

Causes.—Splints are hereditary in a very high degree—more so, perhaps, than any other affection of the limbs. They usually appear between the ages of two and five years, but they are by no means rare in yearlings, and may occasionally be seen in foals. Owing to the great predisposition to them inherited by our horses, they are easily provoked to growth by too early work, and the imposition of heavy weights on the backs of the young and immature. Blows inflicted by one leg upon the other occasionally cause splints, and many cases are referrible to the concussion or jar induced by the high-beating action which some animals display.

How far conformation and indifferent shoeing may take part in the production of splint it is difficult to say, but there are reasons for the belief that they operate as inducing causes.

Symptoms.—Although, as a rule, splints are obvious enough either to the sight or touch, this is by no means always the case. In some instances the greatest care in the manipulation of the limb is required to detect them, and occasionally they evade the most diligent search. This is especially the case when they are small and placed on the posterior aspect of the limb. In the early period of their formation, while the *periosteum* or covering of the bone is still inflamed, pressure applied to the splint induces pain, and causes the animal to jerk away the leg forcibly. Abnormal heat may or may not be discernible at this time.

Pain, however, in the splint itself is not always necessary to splint lameness. In many instances the defective action remains after all inflammation has subsided in the bone. In these cases impaired movement is mainly due to mechanical irritation excited in the tendons and ligaments on which the projecting splint encroaches. The lameness resulting from this disease affects the action in various ways, according to the situation of the growth.

When the splint is at the back of the shin the knee is imperfectly flexed, and the movement of the limb is consequently stiff and short. When it encroaches on the knee the same imperfect action is observed, with the addition that the limb is slightly abducted or thrown outward at each step. Splint lameness is aggravated by the jar of hard ground.

Treatment.—On the first appearance of lameness from this cause the horse should cease to work, and be placed in a well-littered box. A dose

of physic and light diet should be promptly adopted as preliminaries to more active treatment. After the effects of the medicine have passed away the leg should be irrigated with cold water for half an hour three times a day, and in the intervals a cold wet bandage should be applied to the affected limb. Should the lameness continue after four or five days, a blister may be applied to the inner and outer side of the leg between the knee and the fetlock, and repeated once or oftener according to the requirements of the case. Should this not succeed, it may be necessary to puncture the splint with the pointed iron, or to insert a seton over it, or, as a last resort, to cut through the covering of the bone (periosteotomy). It need hardly be said that the operations last referred to can only be undertaken safely by the qualified veterinarian.

OSTITIS—INFLAMMATION OF BONE

A casual inspection of a bone shows it to consist of several structures. Outwardly will be noticed a thin fibrous membrane (periosteum). This not only covers the exterior of the bone, but serves as a bed in which blood-vessels break up into small branches before entering it through the minute openings provided on the surface. With these small vessels fine fibres from the periosteum itself also pass into the tissue of the bone, and become connected with another membrane lining it within termed the *endosteum*.

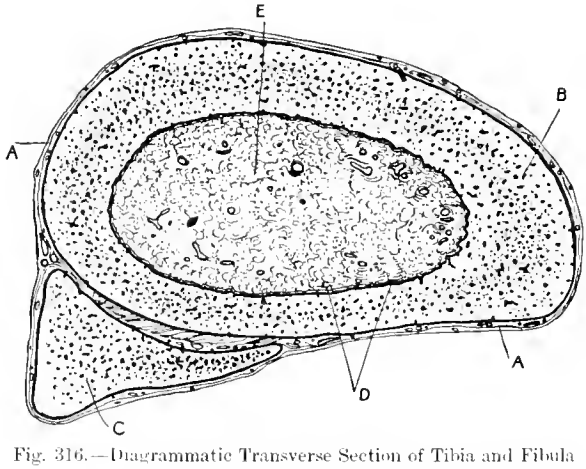


Fig. 316.—Diagrammatic Transverse Section of Tibia and Fibula

A, The two layers of the periosteum with blood-vessels, &c. B, Bone of the Tibia. C, Bone of the Fibula. D, Endosteum. E, Marrow.

The several structures may separately suffer from inflammation, but the intimate connection existing between them renders it impossible for one to suffer without the others being soon involved in the disease.

Inflammation occurring in the periosteum is known as *periostitis*, in the bone as *ostitis*, and in the lining membrane of the bone as *endostitis*.

Periostitis.—This disease is mostly found to exist in the long bones of the limbs of young animals when growth of the skeleton is most active, and the vessels of the membrane are highly charged with blood for the supply of its nutritive requirements.

It is especially frequent in the shin-bones of young race-horses, where it is commonly known among trainers and stablemen as "sore shins".

Periostitis may be acute or subacute. In the former case it soon spreads to the bone, and may cause portions to die and to slough. In the latter, which is the more common form of the disease in the horse, the action is of a more formative kind, and usually results in the thickening of the periosteum and the formation of new bone.

Two factors are concerned in this destructive process:—1. Exudation is thrown out from the vessels within the bone into the minute canals which they traverse. This continuing, the vessels are pressed upon by the exuded matter, and the circulation of blood being thereby interfered with the nutrition of the bone suffers accordingly.

2. Exudation also takes place from the vessels beneath the periosteum, lifting the membrane away from the bone, with the result that a portion of the latter dies, partly from want of the nourishment which the vessels of the periosteum afford to it, and partly also from pressure on the vessels of the bone itself by the matter exuded around them.

Separation of the dead piece of bone from the living must in such circumstances take place. During this process abscesses form over the site of the injury, and pus (matter) is discharged by one or more openings in the skin.

Symptoms.—Acute pain, great heat, and lameness are early symptoms of the disease. Pressure over the part causes sudden withdrawal of the limb. Swelling soon appears—at first firm, then less resisting, and ultimately fluctuating. An abscess forms and breaks, and finally the dead bone, if not removed by an operation, crumbles away and escapes in small particles with the pus.

Treatment.—Perfect rest is the first requirement in these cases. An incision should be made through the periosteum as soon as the disease is found to exist. This will afford an opportunity for the escape of matter as it is formed, and prevent any serious separation of the membrane from the bone by its accumulation beneath it. Where this has already taken place it is desirable to make a bold opening, and after irrigating the wound freely with antiseptic solution continue the treatment on the principles laid down for dealing with wounds on the antiseptic system. It should not be overlooked to remove any dead piece of bone that may exist, as soon as it is sufficiently detached to be taken away.

Acute periostitis is only of seldom occurrence, and perhaps the most common examples are those which occur in the lower jaw as the result of injury inflicted by the bit. Occasionally it is seen in the bones of the extremities after severe blows.

Chronic Periostitis.—This form of the disease most commonly presents itself in that affection of the limbs termed sore shins and splints. It may, of course, attack any of the bones of the skeleton, but those of the legs are by far the most frequently involved. See Sore Shins and Splints.

Fig. 317.—Acute Ostitis

1, Sequestrum or Slough. 2, 2, Cloacæ or openings for escape of pus and dead bone. 3, 3, New bone enclosing the sequestrum.

Fig. 318.—Acute Ostitis

1, Sequestrum or Slough. 2, New bone enclosing sequestrum.

Acute Ostitis is comparatively of seldom occurrence in the horse. Why this should be so it is difficult to say precisely, but the absence of those constitutional conditions which favour its production in man is no doubt in some measure a safeguard against it in our equine patients. The fact that amputation is but seldom resorted to in the horse may also contribute to render him less frequently the victim of this disease.

It is mostly observed in the bones of the extremities, and especially those below the knees and hocks.

Sometimes it is localized or confined to a particular part, or it may involve a large tract, or even the entire bone. The writer has seen the whole of the os suffraginis or large pastern bone destroyed, and its remains enclosed in a perforated shell of bony matter, formed around it by the periosteum (figs. 317, 318). It sometimes occurs in the upper and lower jaw-bones.

Causes.—Acute ostitis is the result of injury inflicted on the bone by external violence, the most severe cases being those in which the bone is penetrated by some sharp instrument, as when the foot bone is punctured by a nail. The example figured was caused by the foot of the horse being brought violently to the ground when attempting to save

himself in slipping. The disease may also occur in connection with fracture of the bone when the result of extreme violence.

Symptoms.—When occurring in the bones of the extremities, it is attended with acute lameness and suffering. The parts around the bone are much swollen, hot and tender, and considerable difficulty may be experienced in defining the precise stage and nature of the disease. Sooner or later an abscess forms, followed by another and another, from which flows a blood-stained and offensive matter.

Later the bone begins to crumble away, and the debris escapes in granular particles with the discharge. The tendency in these cases is to blood-poisoning, and the formation of abscesses in one or another or several of the internal organs. It is seldom that the patient recovers from such an attack so as to be again useful.

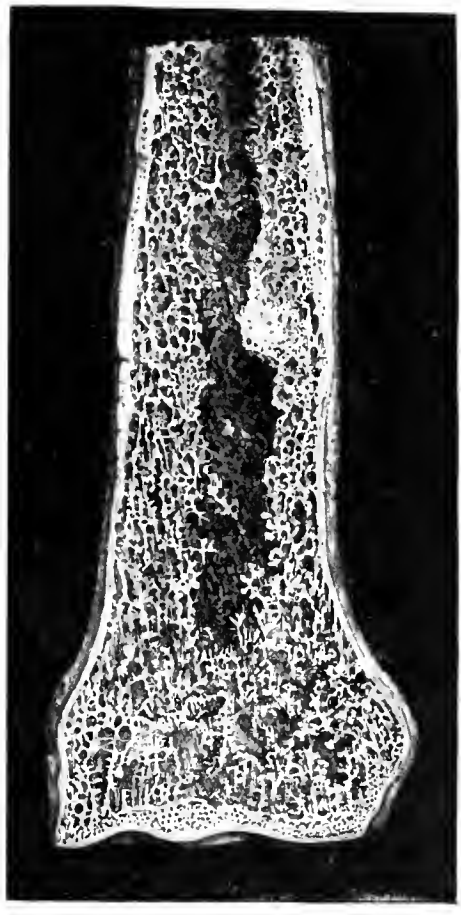


Fig. 319.—Rarefying Chronic Ostitis

Chronic Ostitis.—This is the form in which ostitis most frequently presents itself in the horse. Ringbones, some splints, and various other excrescences on the bones of the limbs and other parts of the skeleton are frequently of this nature.

At first the affected bone becomes porous and spongy (fig. 319), as the result of the inflammatory exudation pressing upon the vascular canals of the bone and promoting their absorption and enlargement. As a result of this the bone tissue becomes changed from a close compact structure to a loose and spongy condition. This is what is known as *rarefying* ostitis.

As the inflammation abates, the material thrown out of the vessels into the structure of the bone, by which the rarefaction was produced, is itself converted into bone.

The effect of this is to change the part from a soft spongy condition to a state of great density and hardness (fig. 320).

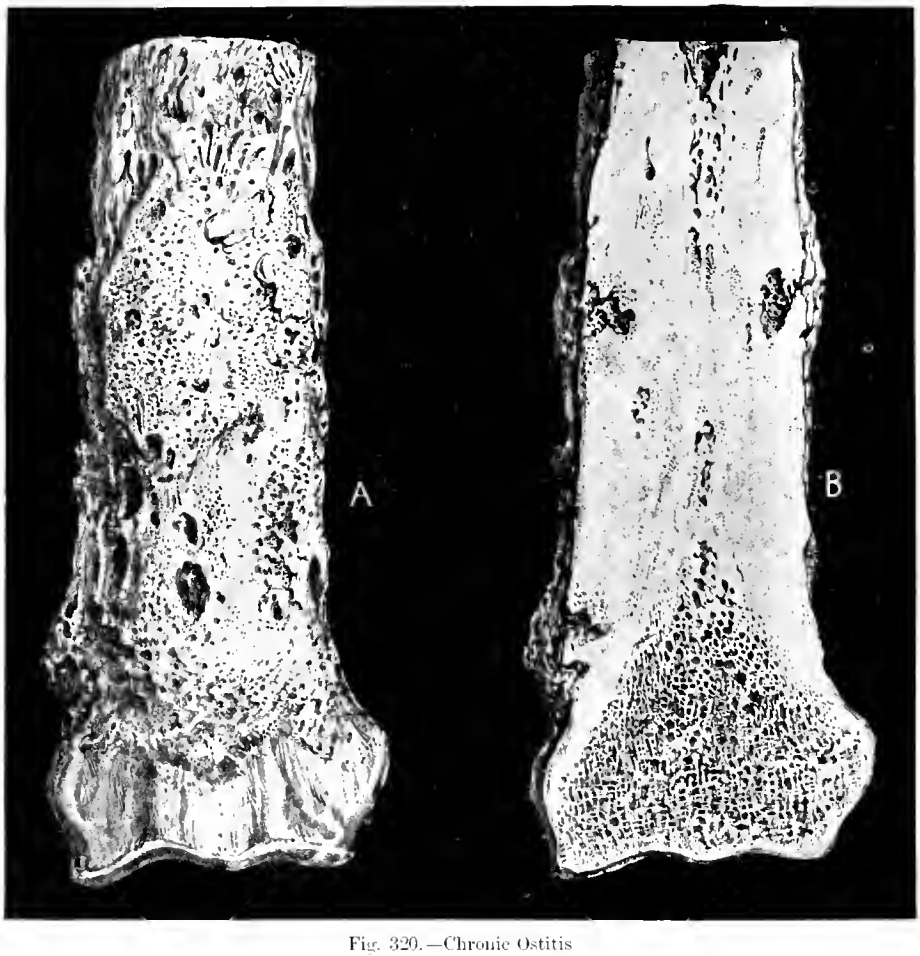


Fig. 320.—Chronic Ostitis

A, Lower portion of Radius of horse, showing results of Chronic Ostitis. B, Section of the same, showing hard, dense condition of the bone.

NECROSIS AND CARIES

When bone is so far damaged by disease or accident as to cause it to die, it is said to be affected with necrosis or caries, one or the other, according to the mode of death. If a considerable quantity of the tissue be destroyed at one time the term "necrosis" is used, but if the bone gradually melts away or breaks down into minute particles during a progressive ulceration it is spoken of as "caries".

Necrosis.—Causes. The more common causes of necrosis as it affects horses are blows and bruises directly applied to the bone; hence it occurs that those bones or parts of bones most superficially placed, and consequently most exposed to injury, are especially liable to the disease. Bones deeper seated and enveloped in thick layers of muscle are comparatively

seldom affected. For the above reasons necrosis is found to implicate the front of the shin or canon bones both in the fore and hind limbs, and also the lower jaw-bone and the ribs. The shin-bones in the act of jumping are not unfrequently brought into forcible contact with posts and rails, gates and stone walls, or they are injured by kicks from other horses, &c. The most common seat of the disease is the lower jaw at the resting-point of the bit, where the resistance to runaways, pullers, and hard-mouthed horses is specially applied. In addition to external violence necrosis may be induced by acute inflammation of bone in any part of the skeleton.

Symptoms.—Where an injury is inflicted on bone sufficiently severe to destroy its vitality the immediate effects are more or less swelling, heat, and tenderness of the part, and when involving the bones of the extremities more or less lameness. In superficial bones the swelling is not generally considerable and may soon altogether subside, leaving behind, however, an abiding tenderness of the part. Sooner or later the swelling reappears, or if still present becomes considerably increased, while the heat and soreness return with greater severity than before. As the inflammation becomes more and more severe an abscess is formed, which may break, and heal, and break again and again, and finally resolve itself into a chronic running sore. During this time the dead piece of bone is being separated from the living. If a probe be passed into the wound the harsh grating of its point on the dead bone will be felt. These cases are always of a protracted nature, and when neglected extend over months.

When the lower jaw is the seat of injury the animal jibs when ridden or driven, or turns the head towards the side on which the disease exists. The saliva is raised into foam by champing of the jaws, and may be stained with blood. Feeding is rendered painful, and swelling appears on the outer part of the injured bone and extends for some distance around it. If the finger be applied to the spot a wound in the gum will be found corresponding to the injured part, through which the dead fragment is readily felt, and if completely detached may be brought away. The odour emitted in these cases is usually very offensive. Although sloughing may have completely taken place, and the dead bone have been quite detached from the living, it may still be retained unless means are adopted for its removal.

Treatment.—Here the aim and object of treatment should be to remove the dead bone as speedily as possible, but no attempt should be made in this direction until nature has defined its limits and well-nigh completed its separation from the living. If after this it is allowed to remain it becomes a source of irritation, and the wound continues to

discharge and refuses to heal. It becomes necessary, therefore, that a periodical examination of the diseased part should be made, in order that the earliest opportunity may be seized to extract the offending matter. For this purpose it may be necessary to lay the wound open. This done the finger should be introduced, and the necrosed mass will be found probably grown over by granulations or "proud flesh", or at least united by them to the body of the bone. If detachment has not been completely effected a little force, by means of a small lever placed under the dead fragment, may be sufficient to disconnect it.

The dead bone having been removed the wound may be freely dressed with a strong solution of chloride of zinc, and afterwards treated with antiseptic applications until reparation is complete.

OSTEO-POROSIS—BIG HEAD

By this term is understood a swollen, soft, and porous state of the bones. It is a constitutional disease usually involving the entire skeleton, but manifesting itself with much greater severity in some parts than in others. This is especially the case with regard to the head, from which circumstance it has received the common appellation of "big head".

Not only is this difference observed in different regions of the skeleton, but likewise in different parts of particular bones. In the long bones of the legs, for example, it becomes much more pronounced at the extremities where they unite to form joints, and where, as in the bones of the face, the osseous tissue is naturally of a loose, spongy character (cancellated).

Osteo-porosis is essentially a chronic and slowly progressive disease affecting all classes of horses, both male and female, and at all periods of life, but young animals seem to be more predisposed to it than those advanced in years.

It has not been found to exist to any considerable extent in Great Britain, but in America, India, and Africa it is of more frequent occurrence.

Origin.—Although much has been written both in this country and on the Continent with regard to its origin, the writer is compelled to admit that practically nothing is known as to the causes which give rise to it. Captain Hayes, who refers to numerous cases as coming within his experience in Africa and India, believes that "feeding on unnutritious grasses is one of the chief causes of the malady". This statement, however, receives no support from experience in this country, where the cases hitherto recorded have been stabled animals receiving a liberal supply of good food. By others it has been attributed to damp and insanitary

stables, and Professor Varnell saw reason to regard it in one instance as in some way connected with a too exclusive bran diet, and deficiency of lime in the food. It is quite clear that the precise nature and conditions of the origin of the disease still remain to be determined.

Symptoms.—The first noticeable indications of the affection are slight stiffness and subsequent lameness in one or more of the limbs, with tenderness over the region of the joints, which sooner or later become enlarged. The disease may attack all the limbs more or less severely at once, or in

Fig. 321.—Osteo-porosis

Bones of the face enlarged, thickened, and rendered soft and spongy.

Fig. 322.—Osteo-porosis

Lower Jaw affected by the disease.

succession at varying intervals of one to three weeks. At the same time the head and face attract attention by the gradual obliteration of their sharp angles, and the steady increase in size of the head as a whole. At this time there is no perceptible constitutional disturbance. The animals feed and rest and keep their condition. The swelling of the joints may to some extent subside, only, however, to return again and add to the permanent enlargement.

As the disease progresses the bones continue to increase in size and

at the same time to become spongy and soft, so much so in some parts as to yield to the pressure of the fingers from without. When in this condition the animal has difficulty in rising, and the ligaments of the joints soon fail to resist the weight imposed upon them, and break from their connections with the soft and yielding bones.

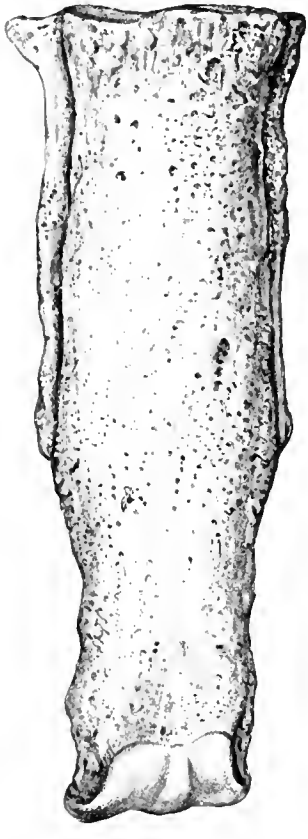


Fig. 323.—Osteo-porosis

Metacarpals of horse affected by the disease.

In the early stages of the disorder the turning movements are noticeably stiff, and pressure, if applied to the spine, causes pain and shrinking.

The head continues to increase in size and to present an unsightly appearance. The lower jaw becomes thick and rounded, and as the bones of the face enlarge, the teeth become loose in their sockets and more or less displaced. At this time mastication is imperfectly performed, nutrition is impaired, and symptoms of constitutional derangement appear and continue to become more and more severe to the end. In fatal cases the duration of the disease extends from two to eight months or longer.

Treatment.—Osteo-porosis is usually fatal. It is worthy of note, however, that a case given up to the writer was returned cured after undergoing three courses of iodide of potassium and nux vomica at intervals of three or four weeks.

Post-mortem Examination.—After death no special lesions are found to exist in the abdominal or thoracic viscera. Many or all the bones of the skeleton are enlarged (fig. 323), spongy in texture, and soft in consistence.

The capsular membranes of the joints of the extremities are much thickened, and the articular ends of the bones are denuded of their cartilage, and present a worm-eaten appearance.

SPAVIN

The term spavin is applied to two distinct forms of enlargement of the hock, one being a bony excrescence (bone-spavin), and the other a distension of the joint capsule with fluid (bog-spavin). Spavin is also spoken of as occult when the action declares the hock to be the seat of mischief in the absence of any outward physical change. Bog-spavin is dealt with in the section on Diseases of Joints.

BONE-SPAVIN

A bony outgrowth on the inner and lower part of the hock is termed a bone-spavin (fig. 324).

The enlargement usually appears towards the front, but it may occupy a backward position, or extend from front to back. Spavins vary in size as well as in position. Sometimes they are small and with difficulty identified, at others they reach a considerable size. The same variation appears in respect to form. They may present themselves as rounded, or more or less pointed and irregular swellings, or as a projecting ridge, extending across the hock from back to front. Usually they appear on one hock only, but frequently both are affected either simultaneously or consecutively. Hocks of every variety of size and conformation, from the biggest and best to the smallest and weakest, are liable to become affected, but it goes without saying that the disease is most frequently found in the latter.

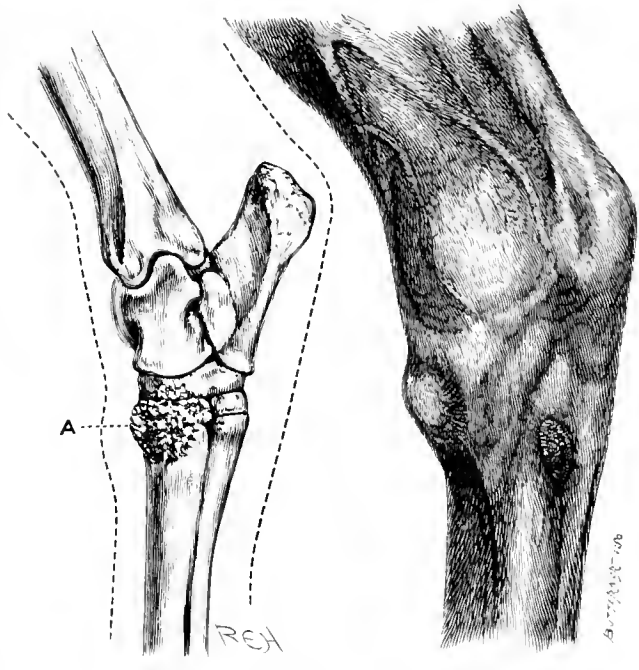


Fig. 324.—Bone-Spavin. A, Spavin.

Causes.—The predisposition to spavin is unquestionably hereditary. Horses with straight quarters and upright pasterns seem especially liable to it. Sprain and concussion to the joint, acting separately or together, are the exciting causes, and there is reason to think that these accidents are more especially likely to occur when animals are forced in their work under circumstances of fatigue and want of condition and development. The outward enlargement is an evidence of the inflammation going on in the articular surfaces of the bones.

The great variation found to exist in the conformation of the hocks of different horses, and indeed sometimes in the two hocks of the same horse, has ever been a stumbling-block to the veterinarian in the diagnosis

of spavin, and a mine of wealth to lawyers and learned counsel. Coarseness or lumpiness is a recognized condition of normal development in the hocks of some horses, and to distinguish between the natural irregularities of coarseness and those resulting from disease is always difficult and sometimes impossible. If these facts were more generally recognized and allowed by veterinary practitioners, much of the litigation which now engages our law-courts would be avoided, and the veterinary profession would be saved from those strange exhibitions of discrepancy which tend to weaken public confidence in their opinion and advice, if they do not engender distrust.

Symptoms.—The immediate effect of the jar or sprain giving rise to spavin is to produce lameness, sometimes slight, sometimes severe. This may or may not pass away, to return again when the enlargement of the hock appears and encroaches upon the connecting ligaments of the joint. The action of the spavined horse is marked by stiffness of the affected limb. In movement the hock is imperfectly flexed and the leg has the appearance of being carried.

Compared with the opposite limb the stride is short and limping, and the quarter is noticed to drop when the foot is brought to the ground. If continued in work the toe strikes the ground and in time becomes worn. Spavin lameness is most severe after a rest, and particularly noticeable when the horse first leaves the stable, but it improves as he goes on. Heat may or may not be detectable in the joint, and as the patient stands the limb is rested on the toe or front part of the foot.

Treatment.—On the first appearance of the disease the animal should cease to work and receive a dose of physic. At the same time fomentations or hot bandages should be applied to the hock until the existing inflammatory action is subdued.

Cold-water irrigation for a few days should follow, after which a repetition of blisters at intervals of a fortnight or three weeks may suffice to effect a cure. Should, however, the lameness still continue, choice must be made between the operations of firing and setoning, in either of which case a long rest at grass will be desirable.

Horses with spavins are frequently restored to service and continue to work without interruption for the rest of their lives. Others, however, are permanently crippled. The latter result is most frequent when the spavin occupies a forward position.

METACARPAL PERIOSTITIS—SORE SHINS

This is an ailment of common occurrence in race-horses, but comparatively seldom seen in other varieties. The greater liability of the one over the others is associated with early training, while the bones are in active growth, and by their imperfect development specially susceptible to injury and disease.

The term "sore shins" has been applied to it on account of the extreme tenderness and pain found to exist in that part of the leg between the knee and the fetlock joint. The mischief, however, does not always stop here, but may also involve the large, and sometimes the small pastern bones, developing there the same soreness of the surface, and in some instances provoking an outgrowth of bony matter in the form of ring-bone.

The fore-limbs, for reasons presently to be stated, are more particularly the seat of sore shins, although the hind ones are not wholly exempt.

Pathologically considered, "sore shins" at the outset consists in an inflamed condition of the periosteum, or covering membrane of the bone; but unless soon relieved from the operation of the cause, the shin-bone itself soon shares in the disease. At this time the pain and lameness become aggravated, the periosteum is much thickened, and a rough bony growth appears on the surface beneath it.

Causes.—Youth, and want of development and power of resistance in the bone is, as we have observed, the predisposing element to sore shins, and this is materially intensified when, as sometimes occurs, there is a hereditary predisposition to the morbid growth of bone.

The exciting cause is to be found in concussion, arising from the forcible impact of the feet with the hard ground in the act of galloping, when the "jar" is transmitted along the shaft of the bones, whose covering becomes irritated and inflamed. It will, therefore, be seen that in proportion as the ground is hard, and the weight carried by these juveniles is considerable, so will be the liability to injury. It is for this reason that the disorder appears during seasons of drought, when the ground is dry and resisting instead of being soft and spongy.

Symptoms.—The lad who habitually rides a horse in his daily work is often the first to detect the oncoming of this disease. He recognizes a growing sense of discomfort arising out of a change in the animal's action and spring. Then it soon becomes obvious that he is going short in his stride, and some difficulty is experienced in setting him going and keeping up the pace. Examination of the legs at this time reveals more or less heat and soreness along the course of the canons, and especially

in front. Later, the legs become somewhat enlarged from the knee downward, and present a rounded appearance. The fetlocks are "filled", and the swollen parts "pit", when pressed upon, like soft dough. Lameness now appears in all the paces, and the animal moves with a stiff, sore gait, which becomes aggravated from day to day when work is continued.

Treatment.—In slight cases it may be sufficient to ease a horse in his work, give him a mild dose of physic, transfer him for a time from the hard turf to the tan, and irrigate the legs two or three times daily with cold water. If, however, the patient has no pressing engagement his work should be reduced to walking, with as little weight on his back as possible. In more severe attacks it is better to throw the horse out of work altogether, and apply hot bandages to the legs during a course of physic.

When the inflammatory action has been subdued, then a mild blister may be applied to the shins from the knee downwards, and repeated in ten days or a fortnight, and again, after a similar period, if circumstances appear to call for it. Iodide of potassium in 1 or 2 dram doses may be given in the food morning and evening for a week, but not until the physic has ceased to act. The medicine should then be discontinued for two or three days, and renewed again for another week, and the same course may be repeated if necessary. In all cases where horses evince the slightest signs of sore shins the weight should be promptly reduced, the pace let down to walking, and, as far as practicable, the work should be done on tan, in cold wet bandages. Many a severe attack may be warded off and horses kept in work by the early adoption of proper measures.

In some instances, as the result of neglect, these cases assume a chronic character. The shins become considerably enlarged and covered with a rough bony growth, while the periosteum is much thickened, and continues to lay down bone on the shaft of the canons. Here firing with the pointed iron may prove serviceable after a run of two or three weeks at grass in a damp meadow.

After an attack of this disease horses should not resume work too early, and care should be taken that the ground is soft, and the pace for a time slow. Cold wet bandages should be worn for a week or two after work has been commenced, and occasional irrigation with cold water will assist in imparting tone to the legs.

15. FRACTURES

When a bone is broken into two or more parts it is said to be fractured. Fractures assume a variety of forms, each of which presents some feature requiring special consideration, either in regard to diagnosis or treatment. They may be either *partial* or *complete*; *simple* or *compound*; *comminuted* or *impacted*.

When a bone is broken, but the breach only extends through a portion of its substance, the fracture is said to be *partial*. If, however, the bone is divided into two separate parts, it is a *complete* fracture.

A *simple* fracture is one in which the broken bone is not connected with an external wound; where such a wound exists and communicates with it the fracture becomes a *compound* one (fig. 329).

If instead of the bone being broken into two parts it is divided into three or more — smashed — a *comminuted* fracture results (fig. 325).

It sometimes happens that when a bone is broken the broken end of one piece is driven into that of the other. Such a fracture is said to be *impacted* (fig. 328).

Bones break in various directions; hence fractures are spoken of as *transverse*, *longitudinal*, or *oblique* (fig. 326).

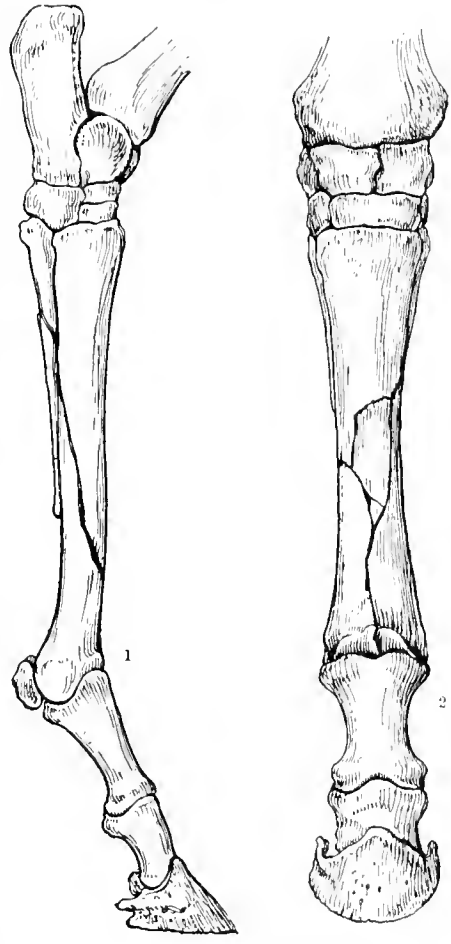


Fig. 325.—Fractures
1, Simple. 2, Comminuted.

A transverse fracture follows a line at a right angle with the shaft of the bone. This is a comparatively rare form of breakage, but is sometimes seen in the scapula, the ilium, the olecranon or elbow, and the calcaneus, or point of the hock.

Great importance attaches to the relations which the two or more broken pieces maintain towards each other after the fracture has taken place. In some instances they continue to remain in their natural position

throughout the healing process, a condition favourable of course to reparation, and very much to be desired.

In others, however, the fracture is accompanied or followed by more or less *displacement* of the divided parts, and all the bad consequences which attach to it.

This separation of the broken pieces may result from the same cause, and at the same time, as the fracture, or it may occur some time afterwards by the weight of the body forcing the parts asunder; or by movement, or as a result of the contraction of muscles which are attached to them.

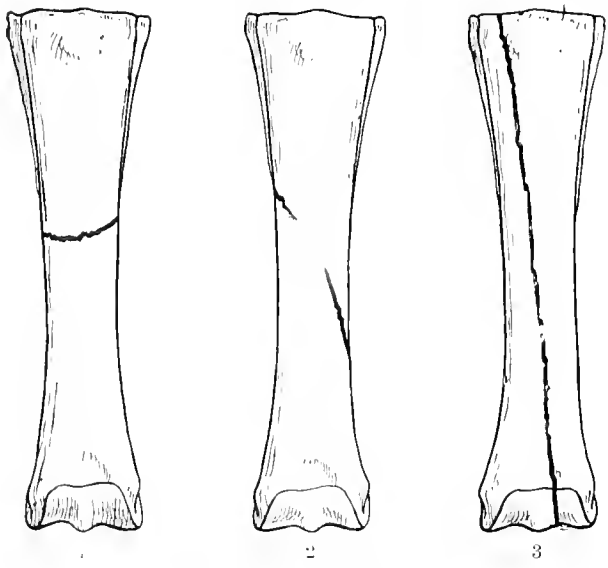


Fig. 326.—Fractures

1, Transverse. 2, Oblique. 3, Longitudinal.

The liability to displacement is much greater in some bones than in others. In the canon it is almost invariable, while in the pastern it is comparatively rare. This difference will be best understood by reference to fig. 327, where it will be seen that nearly the whole of the front and back of the pastern bones, and to a less extent the sides, have attached to them strong ligaments and tendons, so that when either of them is broken the parts are held firmly in their position, and unless the force acting upon them is very considerable, displacement is prevented.

Displacement of the broken fragments may be immediate, *i.e.* may occur at the time of the accident, or it may be deferred for a period varying between a few hours and a few days, and during the interval between the fracture and the separation of the broken pieces many animals have been known to continue to perform ordinary work without showing inconvenience.

Causes. — Two classes of causes are recognized as conducing to the fracture of bones, viz., *predisposing* and *exciting*.

Predisposing Causes.—For various reasons some bones are more liable to fracture than others, and this represents their predisposition.

In looking over the body it is not difficult to see that certain bones are much more exposed to collision and to external violence by virtue of their position than others Of these the points of the haunch project-

ing from the quarters afford a striking example. They display a special liability to be brought into forcible contact with door-posts while horses are passing into or out of the stable, or through narrow passages, and to receive the first impact of the ground where, as sometimes occurs, their hind-legs slip from under them, and they fall helplessly on their side.

The canons or metacarpal bones, unprotected by muscles, are exposed to the full force of any external violence that may be applied to them, besides which their movements are sharp and forcible, and meet colliding objects with great resistance.

The large pastern also, by virtue of its position, is specially liable to fracture, and in a less degree also the forearm and lower thigh.

Age imparts a state of brittleness to bones which is not found in the young and the adult; hence old animals are more prone to fracture than younger ones.

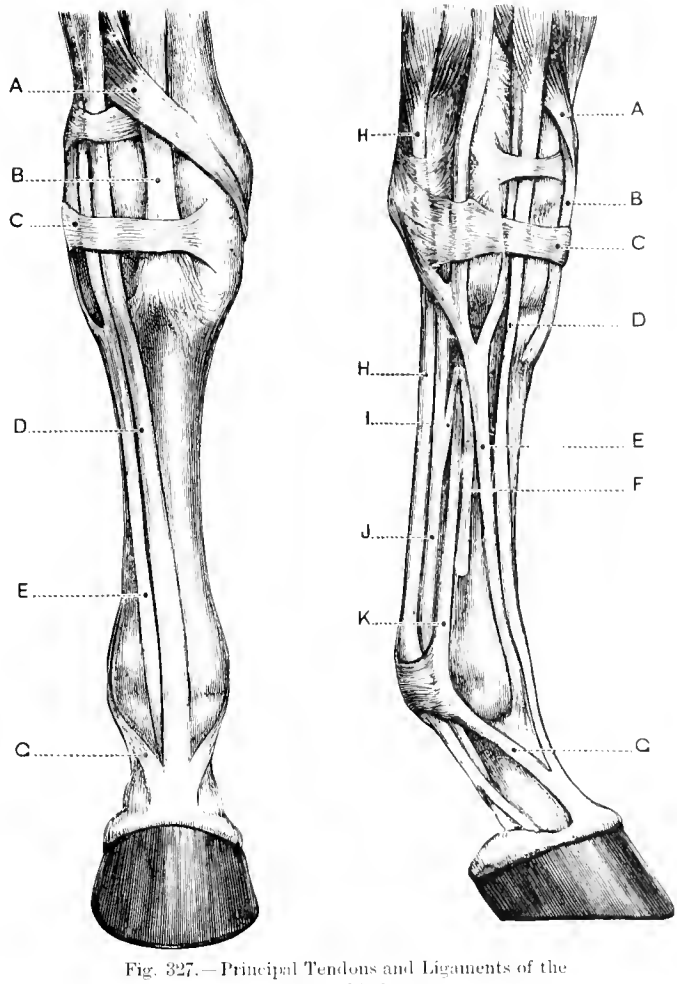


Fig. 327.—Principal Tendons and Ligaments of the Fore Limb

1. Front View.

A, Extensor Metacarpi Obliquus.
B, Extensor Metacarpi Magnus.
C, Annular Ligament.
D, Extensor Pedis.
E, Extensor Suffraginis.
G, Outer Branch of Suspensory Ligament.

The ligaments of the pastern are more fully shown in fig. 356, page 272.

2. Outer Side View.

A, Extensor Metacarpi Obliquus.
B, Extensor Metacarpi Magnus.
C, Annular Ligament.
D, Extensor Pedis.
E, Extensor Suffraginis.
F, Outer Small Metacarpal or Splint Bone.
G, Outer Branch of the Suspensory Ligament.
H, Flexor Pedis Perforatus.
I, Subcarpal or Check Ligament.
J, Flexor Pedis Perforans.
K, Suspensory Ligament.

In early life, before the epiphyses or prominences which are connected with the shafts of bones have become firmly united by ossific union, they

are liable to be torn away by muscular contraction, or otherwise forcibly displaced.

Structural alterations, the result of disease, by weakening the bone tissue, lessen its power of resistance to ordinary forces, and thereby conduce to fracture.

The navicular bone, after a period of ulceration, breaks beneath the weight thrown upon it in action.

The imperfectly-developed bones of the rickety foal, after bending under the strain imposed upon them, may sooner or later present a partial or complete fracture.

Various other morbid changes, such as cancer, osteo-porosis, melanosis, &c., render bones specially amenable in this direction to causes which they would otherwise resist.

Season of the year, and the nature of the surface over which horses travel, tend to increase the liability or predispose to fracture.

In winter, when the roads are covered with ice, and in towns where horses have to travel over wood pavement or other smooth surfaces made slippery with water, legs, hips, and ribs are in consequence frequently broken.

The **exciting** causes of fracture are: 1, external violence, such as kicks, collisions, falls, blows, twists, &c.; and 2, muscular contraction.

Violence may operate either directly or indirectly, *i.e.* it may break the bone to which it is immediately applied, or some other at a distance from it. It sometimes occurs that a horse falling upon the poll, and striking the occipital bone, breaks the sphenoid bone at the base of the brain. Horses fracture the os suffraginis, or long pastern, or even the canon-bone by pitching on the toe while endeavouring to save themselves from a fall, or in jumping or galloping.

Examples of fracture as the effect of muscular contraction are seen in those common accidents which occur to horses while being cast, or in the course of a surgical operation. The violent struggles to free themselves from restraint too commonly give rise to a broken back, or a broken thigh, or the breaking away of one of the epiphyses or bony projections from the shaft of a bone.

Symptoms.—To determine the presence of a fracture in the horse is sometimes a very difficult, and may be an impossible task. The parts to be dealt with are large, heavy, and do not lend themselves to that thorough and searching examination which is so capable of being made in the smaller animals. Besides, the excitable and refractory character of the horse greatly interferes with that full control so necessary to a successful diagnosis. Of course we can bring to our aid the restraining influence of

chloroform, but even this is not an unmixed good. Whether a horse be cast before its administration, or he allowed to fall while under its influence, there is in both cases the danger of displacing the broken bones and converting a simple into a compound fracture, or causing a troublesome displacement of the broken parts.

Before any such step is taken it is desirable to exhaust all other means at our disposal.

The symptoms exhibited as the result of fracture will vary according to the situation and the purpose which the bone serves.

Fracture of the long bones of the extremities is not generally difficult to diagnose. It may be at the time of its occurrence someone heard a "snap". If displacement result, this would be followed by sudden and acute lameness and an inability to support weight on the broken limb. The parts below the fracture would hang loosely, the toe would sway involuntarily from side to side, or might be directed backwards. Swelling on the region of the fracture and parts below it soon appears, attended with local inflammation and pain.

Of the many symptoms attending a fracture crepitus is the one which should be specially sought for. It is the sensation or sound which results from the rubbing of one broken piece against the other. In comminuted fractures, where the bone is divided into several pieces, it is soon made apparent; but in some cases of simple fracture it is difficult to develop, and a good deal of care, guided by experience, may be needed to bring it about, and especially in young and fractious animals.

When it does not become at once apparent, the upper segment of the broken bone should be firmly held by an assistant, and the lower one gently rotated, and moved from side to side and from front to back by another, while the operator is engaged in manipulating the seat of fracture.

By this method the broken ends may be made to rub against each other and yield the rubbing sensation or sound which is the evidence required.

In some situations, as where a rib or the pelvis is broken, it is impossible to carry out this method, for the reason that the parts are so situated that they do not lend themselves to the kind of manipulation prescribed.

In fracture of the ribs the part will show soreness to pressure, and some irregularity may be felt in the line of the rib when accessible. By gently pressing the rib inward, or making the animal cough while the fingers rest firmly upon the part, crepitus may be felt.

Fracture of the front ribs is usually attended with more or less lameness of the front limb on the side of the breakage. Fracture of the pelvis may sometimes be felt by passing the hand up the rectum, or crepitus may be

heard by applying the ear over the surface of the quarter while the leg is moved about by an assistant.

The difficulty in question is particularly emphasized in fracture of the neck of the femur, owing to our inability to restrict the movement of the detached head and bring the body of the bone into contact with its broken surface.

In fracture of the thigh or the pelvis or front ribs, where great masses of muscle intervene between the ear and the fracture, crepitus may not be recognized unless movement of the broken parts one upon the other is of considerable extent.

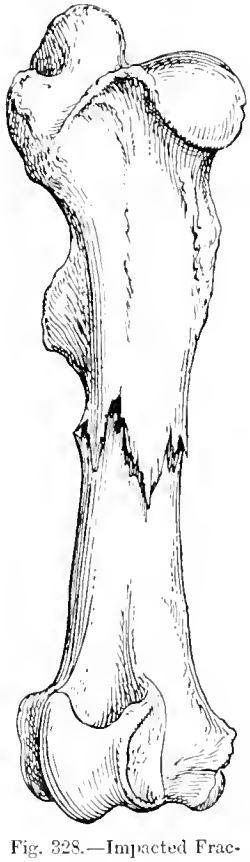


Fig. 328.—Impacted Fracture of Femur

For various reasons this most important and reliable symptom cannot always be made to reveal itself. The broken pieces may be firmly held together so as to preclude any movement one upon the other such as would yield a rubbing sound. This is frequently the case in fracture of the long pastern and some other bones.

In impacted fractures (fig. 328), where one piece of bone is driven into the other, and in incomplete fractures where there is no movement of the imperfectly-divided bone, and in those instances already referred to where the broken pieces are firmly held together by strong ligaments, no crepitus or rubbing is likely to be heard, and considerable difficulty is experienced in bringing it about where a piece of torn muscle or fascia has insinuated itself between the broken ends of the bone, or where one piece has been drawn some distance away from the other by the force of muscular contraction, as where the point of the elbow is raised from the body of the bone by the great extensor of the arm, or a piece of the patella is displaced upwards by the straight muscle of the thigh.

A sound simulating crepitus is sometimes heard where the tissues about the seat of injury become infiltrated with air, or where inflamed tendons rub against their investing sheaths.

This false crepitus, however, does not emit that harsh grating sound which is so characteristic of the rubbing together of the rough surfaces of a broken bone.

Care must be taken not to mistake a dislocation for a fracture. Where the latter takes place in the middle of a long bone there is not much danger

of such an error being committed, but when fractures occur near joints, the case is altered. Here it should be borne in mind that where dislocation exists the displaced bones are more or less fixed, and the movements of the joints are very much restricted or altogether prevented; whereas in fracture the broken bone exhibits excessive mobility, allowing the limb to be moved in various directions to an abnormal extent.

Treatment.—The first consideration which will arise on the occurrence of a fracture in relation to treatment will be the value of the animal, the prospects of a speedy recovery, and to what extent, if at all, his future usefulness will be compromised.

In this connection it will be safe to advise, no less from a sense of humanity than from consideration of economy, that when the animal is of little value he should be slaughtered at once. If, however, it is otherwise decided, the sooner measures of treatment are adopted the better. Owing to the restlessness and unreasoning action of the patient, delay in this respect is fraught with the greatest danger. Many a simple fracture, which, if adjusted at once, would have speedily reunited, has been converted into an incurable compound fracture by the unrestrained use which the animal has been allowed to make of the injured limb after the occurrence of the accident. A horse's highest intelligence fails to realize the advantage of that perfect quiet upon which the surgeon sets so much store, in guarding against an extension of the injury and in bringing about its reparation.

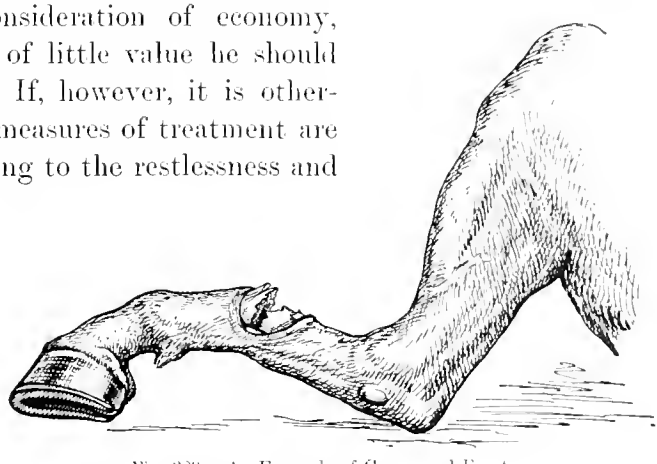


Fig. 329.—An Example of Compound Fracture

The moment a fracture is suspected every means should be adopted at once to restrain the animal's movements, and to provide as far as possible against any undue use or disturbance of the injured limb.

If away from home, a splint should be extemporized, and the horse got into the stable nearest to hand and allowed to remain there while under treatment. If an ambulance cart can be procured without much delay, it would be desirable to convey him at once wherever he may require to go; but it should be kept in mind that the success of treatment is greatly facilitated by the speedy readjustment of the broken bone.

The prospect of treatment—as to whether it is likely to be successful or

otherwise—will depend upon a variety of circumstances, all of which should be well considered before a decision is arrived at.

The position of the bone and the nature of the fracture will claim attention first. A simple fracture without displacement is not a serious matter, unless it occurs in the immediate neighbourhood of a joint, to which the reparative inflammation may extend and occasion some permanent interference with its movements.

Compound and comminuted fractures are always more serious than simple ones, and in all the danger is greatly aggravated where the tissues in the region of the breakage are much bruised or torn, especially where large nerves and vessels are divided by the broken ends of the bone. All these are matters which impart to a fracture in such an uncontrollable subject as the horse a dangerous and discouraging outlook.

A young horse, with a sound constitution and a quiet generous temperament, is much more amenable to treatment than an old, declining, irritable subject.

In the treatment of fracture three important requirements must be fulfilled. The broken fragments must first be brought together and placed in their normal position; they then require to be retained there until they have again become firmly united by the natural process of repair.

The third requirement involves the care against complications, and prompt measures of treatment when they arise.

If there is no displacement of the broken pieces, but by the history and general symptoms of the case a fracture is denoted, the second and third indications only will require to be met.

It is no rare occurrence for horses to break the bones of their legs and to continue to work for hours, days, or weeks without any displacement occurring. A case came to the notice of the writer where a horse in the course of a day's hunting suffered a comminuted fracture of the canons of both hind-limbs. He was noticed to be lame after striking them against a stone wall, and was sent home in consequence. After being fed and dressed and "set fair" he lay down, and when the groom returned to him and caused him to rise, the broken fragments parted, and not till then was the existence of a fracture made known.

The horse was destroyed, and a post-mortem examination showed both bones to be broken into several pieces.

The means by which fractures are reduced or "set" will vary with the seat and nature of the displacement. Some are altogether beyond rectification. This is especially the case in the bones of the spine, and in some bones to which large muscles are attached. By the latter the broken parts

are prevented from being brought together, or they are pulled away from each other by forcible contraction when this has been effected.

This is very much the case in fracture of the thigh and the humerus.

It is more especially in bones below these, and others about the face, that success may be hoped for.

In the absence of a properly-constructed operating-table, by which a horse can be taken off the ground while in a standing posture and again

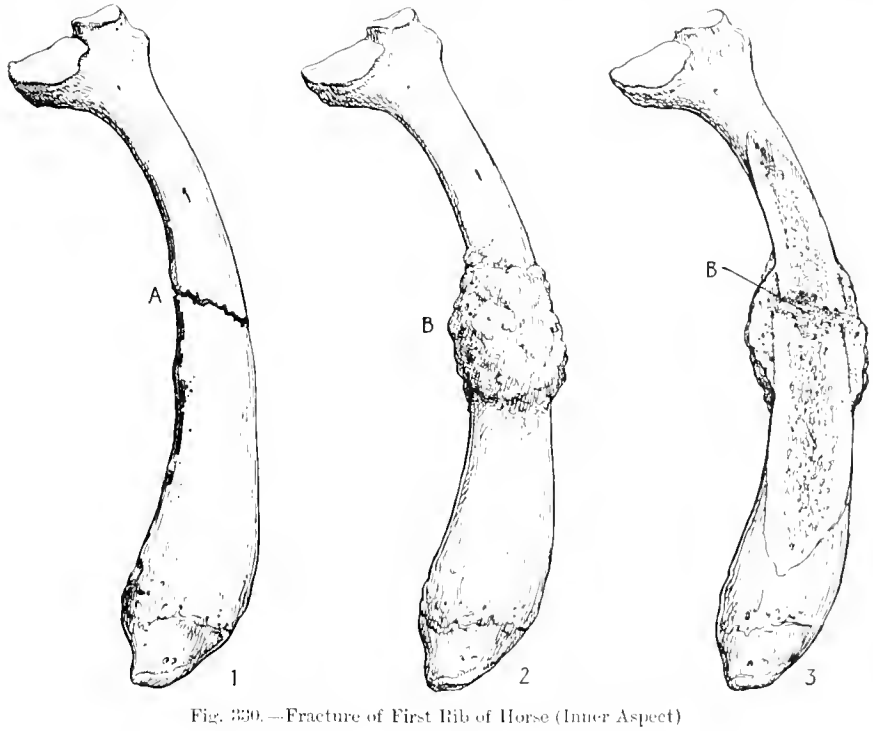


Fig. 330.—Fracture of First Rib of Horse (Inner Aspect)

1, Showing Fracture. 2, Repair of Fracture. 3, The same in section. A, Fracture. B, B, Callus.

replaced directly on his feet, the reduction of a fracture in so large and uncontrollable an animal as the horse is in the last degree difficult.

Without some restraining influence the pain excited by the manipulation of the parts is such as to provoke the most violent opposition. To prevent this the animal must either be cast and placed under restraint, or his resistance must be overcome by the administration of a powerful sedative, or of chloroform or some other anæsthetic. Whichever course is adopted he will require to be brought to the ground, and after the fracture has been adjusted, to rise again.

In the one act the damage may be seriously aggravated, and in the other the work of setting may be completely undone.

In dealing with fracture of the pasterns, canons, and other long bones,

a powerful opiate or a subcutaneous injection of morphia may in some cases so far overcome the irritability of the animal as to allow of readjustment of the broken parts and the application of retaining appliances. Where this fails the horse should be lifted on to a proper operating-table and placed under the influence of chloroform. By this means a more careful examination of the divided bone may be made, and a correct idea of the direction of the displacement and the extent of damage to neighbouring structures is obtained. In this connection it may be desirable to caution the operator against unnecessary manipulation, but when once he has decided what is required to be done, he must not hesitate to apply the necessary force to do it. How that force can best be obtained will be a question for solution when all the facts of the case are known. Hands and apparatus are the means to be applied, and whether one or both are brought into requisition, the direction in which they will be called upon to act will be the same. Ropes and pulleys are in some cases indispensable.

In proceeding to reduce the fracture of a long bone, force will require to be exercised to a greater or less extent in two directions, *extension* and *counter-extension*, and for this purpose one rope will need to be applied below the fracture and the other above it. On each steady and continuous traction is to be made by assistants, while the operator regulates the position of the limb according to his requirements, and directs the broken pieces into their normal position. Those to whom traction is confided should be reminded that sudden and spasmodic or jerky action may add to the difficulties of the operator by exciting the muscles to violent contraction, or lacerating their fibres and with them other correlated structures. The pull in both directions should be as nearly as possible equal in force and steadily maintained throughout in a line with the natural axis of the limb. Those parts of the limb to which the rope or webbing is applied should be well padded with tow.

Where difficulty is experienced in bringing the displaced parts into their proper position, the lower segment of the limb should be moved in various directions by an assistant while the operator manipulates the fracture. Slight rotation, first in one direction, then in another, and a little manœuvring of this kind will sometimes direct the fragments into their normal position. If, however, exact coaptation cannot be effected, the best that can be done must suffice.

We have already pointed out the desirability of early "setting" as favourable to speedy and complete reparation. Where, however, delay has been allowed to occur, some consideration must be given to the state of the parts before readjustment is undertaken. Round and about the broken bone the tissues will be swollen, inflamed, and painful, and more or less

hard and rigid, and the broken pieces adherent to the neighbouring muscles. These are conditions which seriously interfere with replacement, and may altogether prevent it. In such circumstances no attempt should be made at reduction until the inflammation has been subdued by appropriate means, and some discrimination will be required as to the desirability of undertaking such a task in the horse at all.

When the parts have been returned to their proper position, or as nearly so as can be effected, the next requirement to be fulfilled is to secure them in such a manner as to prevent their displacement and favour the process of healing.

In man, whose intelligence is always at the service of the surgeon, this is not a difficult matter, but it is otherwise with the horse.

The one may be put to bed, and all weight having been removed from the broken limb, it may be placed in the position most favourable to reparation, and retained there largely by the will of the patient.

No such sense of self-government is available to the veterinary surgeon. His patient must for the most part support his own weight, and cannot be made to obey the behests of his attendant. His care of the limb is just so much as is dictated by fear of the pain which its movement excites, and the desire to use it, ever present, is always being indulged more or less, with the result that reparation is delayed, frequently imperfect, and not seldom altogether prevented. It is this want of guiding intelligence, this excitability and restlessness, that renders bone-"setting" in the horse so uncertain and unsatisfactory.

Fig. 331.—Bandaging a Fore-leg

Showing the method of applying the bandage over a pad of cotton-wool.

Among the various appliances employed for the purpose of retention, splints and bandages are the main and the most reliable. In fracture of the extremities the patient should always be placed in slings, and the opportunity afforded him to relieve the injured part and rest during the period of restraint.

Splints have for their object the restraining of movement by fixing the limb in such a way that the joints cannot be flexed. Anything which will accomplish this without injuring the part to which it is applied may be employed for the purpose. Narrow strips of wood, thin sheet-iron or tin, leather, gutta percha, strong cardboard, pitch or other adhesive plasters, &c. To obtain the greatest possible benefit from a splint it should be sufficiently long to extend over the joint above and the joint below the fracture. Of course this is not always practicable, but it should always be present to the mind of the operator to adopt any means in his power to restrict as much as possible the action of the joints of the affected limb.

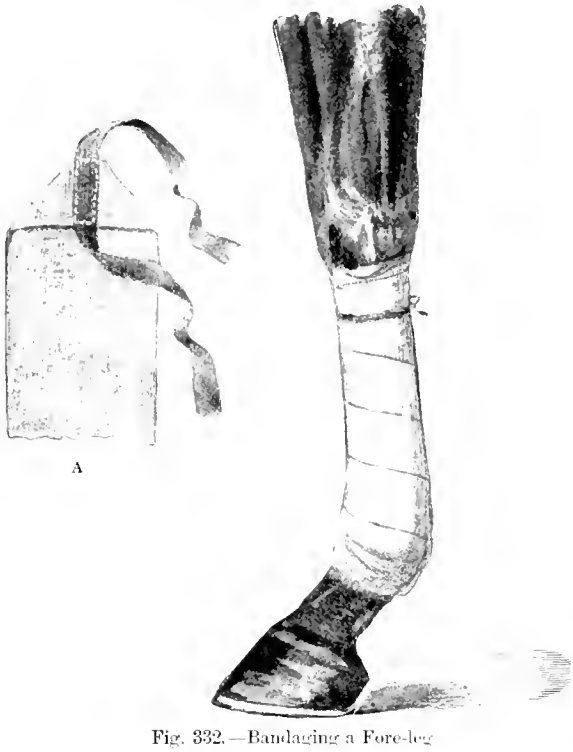


Fig. 332.—Bandaging a Fore-leg

Showing the bandage completed and tied. A, End of bandage with tapes.

Movement of the fractured bone is best controlled by bandages soaked in some material which will solidify and form an unyielding splice over the seat of the broken fragments.

These hardening substances are variously compounded. Nothing, perhaps, is better than starch or flour mixed to the consistence of treacle with the white of egg. Dextrine, burnt alum, and alcohol is recommended by some; and plaster of Paris, with or without flour, and reduced to the consistence of treacle with water, is generally regarded as an excellent preparation.

These appliances will require to be supplemented with some soft compressible substance, by which the irregularities of the limb may be filled in and the pressure of the bandages equalized over the whole circumference of the leg. Where this precaution is neglected there is danger of undue compression of the more prominent parts, resulting in sloughing of the skin and the production of troublesome sores with their attendant evils.

After "setting" has been completed, the limb should be kept under close observation for several days. It will sometimes be found to swell in consequence of injury done to the soft tissues at the time of the fracture,

or from excessive pressure applied to a part or the whole in the adjustment of splints and bandages. In these circumstances relief must be given to the strangulated limb either by cutting the bandages or otherwise removing the pressure. If it is allowed to continue, more or less extensive sloughing will result, and a complication will be added to an already serious condition.

Compound Fracture.—Whether the fracture be simple or compound, the method employed for the reposition of the broken fragments will be the same; but the presence of a wound, and maybe also the protrusion of a portion of the broken bone through the orifice, will give new and special features to the case which will require to be taken into account.

Where a fragment of bone protrudes through the skin, a very material difficulty is added to the operation of reducing the fracture, and serious injury may have been inflicted on muscles, nerves, and vessels in its course outward.

The protruding portion, which is usually the one uppermost, will require to be withdrawn into its proper position, and this will call for much force, great extension and counter-extension, and dexterous manipulation of the limb. If the projecting bone is considerable, its reposition by this means may fail, and the operator will be called upon to decide between two courses, viz., enlarging the opening, or sawing off a portion of the exposed bone. If the former is decided upon, the enlargement must be made in the direction of the axis of the bone, guarding as much as possible against the division of neighbouring vessels and nerves.

It may be that, notwithstanding this, complete return of the bone will be found impossible, in which case the protruding portion, or some part of it, must be removed by the saw. In carrying out this latter operation care must be taken to preserve the periosteum as far as possible.

Where the fracture is a comminuted one, some splinters of bone may be found to be completely torn away from the shaft and lying loose in the tissues of the part. These must be removed, and at the same time any shreds of broken fascia that may be met with. In the after treatment of the wound the antiseptic method must be strictly carried out. The hair for three or four inches round it should be removed. The wound must be freed from clotted blood by means of a sponge soaked in a five-per-cent solution of carbolic acid, and freely irrigated with the same solution.

A good pad of antiseptic gauze soaked in a three-per-cent carbolic solution should be applied over the wound and parts around, and over this a further succession of layers of dry antiseptic gauze, the whole being surrounded by a covering of thin mackintosh or some other impermeable material.

The wound will require to be dressed again some time in the course of twenty-four hours, according to the amount of exudation and saturation of the gauze. Another dressing will be necessary in forty-eight hours, after which the carbolic solution used should be reduced in strength to 1 in 40. Subsequent dressing must be made according to the state of the wound.

It will be understood that in the setting of the bone in compound fracture the wound must be left accessible for the purpose of dressing.

PARTICULAR FRACTURES

FRACTURE OF THE BONES OF THE SKULL

Fracture in this region is comparatively rare, and serious in proportion as the bone is depressed and the brain subjected to compression and traumatic injury.

Those bones forming the front of the cranium (the parietal) are most frequently broken, but fracture of those at the base of the cavity (occipital and sphenoid) is most uniformly fatal in its results.

The causes which produce the former are mainly concussion, especially when the front of the head is brought into forcible contact with sharp objects. The latter is invariably the result of striking the poll against hard ground, or a wall, or other such resisting surface, when the horse in rearing loses his balance and falls backwards.

In these cases unconsciousness and paralysis immediately follow the accident, and death results from concussion and hæmorrhage into and under the base of the brain.

The writer once saw in the practice of the late Mr. Gowing the base of the cranium of a horse, which had at some time been fractured, but recovered sufficiently to allow of the animal resuming work, and to be afterwards sold without any evidence of the injury being detected. He was, however, the subject of repeated attacks of brain disturbance, which ultimately led to his destruction, and post-mortem examination of the head revealed decided indications of an old fracture involving the two bones referred to above—sphenoid and occipital.

Fracture of the parietal bone occurs with or without depression, and it is frequently difficult in presence of swelling to determine to what extent, if at all, the bone has been driven inwards. If, however, consciousness remains undisturbed, and there is no defect in locomotion, it may be inferred for the present that the brain is but little interfered with. But it should not be too hastily concluded that no cerebral

disturbance will supervene later on. For several days after such an accident the liability to brain trouble will continue.

Where the bone is simply split without depression, a dose of physic, and cold cloths applied to the part, with perfect quiet, are all that is required.

If a wound exists, it should be thoroughly cleansed and kept aseptic by repeated dressing on antiseptic lines.

Depressed bone, if provoking brain disturbance, must be levered up, but where no such disturbance exists it should be left alone, and the course suggested above followed out.

FRACTURE OF THE VERTEBRÆ

Fracture of the vertebral column is an accident which is now and again brought to the notice of most veterinarians in the course of their practice, but it is by no means an event of common occurrence in this country. Moller, a German authority, avers that he has "*frequently* seen riding-horses, in violently bucking, or falling over backward, or in arching the neck excessively, fracture a cervical vertebra". Such an experience of one division of the vertebral column, added to that of the others, would seem to warrant the statement that "it is not uncommon in horses"; but the writer is of opinion that Moller's experience is unique and exceptional, and cannot be taken to represent that of the general practitioner.

Fracture of the cervical vertebræ, or neck-bones, is of less frequent occurrence than fracture of the bones of the back and loins. It is seen most frequently in steeple-chase horses and hunters which, having missed their foothold in jumping, or after failing to clear a strong fence, pitch on the face, and bring all the force of impact and weight to bear against the incurved neck. In one case the writer found it to result from the struggles of a horse whose head became fixed between the wall of his stall and the post which supported the manger. It may, no doubt, sometimes arise from a backward fall on the poll.

Fracture of a vertebra may involve the body, or the arch of the bone, or both, or one or more of its processes may be chipped off. When the former are broken through, displacement invariably results, and the spinal cord receives a fatal pressure—fatal, because breathing is arrested in consequence of paralysis of the diaphragm, which receives its nervous supply from the cervical spinal cord, which now fails to transmit it.

Symptoms.—Fracture of the vertebræ in the middle and lower part of the neck is speedily fatal, and in any position the same result sooner or later follows.

FRACTURE OF THE DORSAL AND LUMBAR VERTEBRÆ

It is here, in the back or loins, that fracture of the vertebræ most frequently occurs. In this as in other fractures old animals are much more liable to the mishap than younger ones, owing to their bones containing a larger amount of earthy matter, which adds materially to their brittleness.

When fracture occurs in these divisions of the spine it usually involves one or both of the last two dorsal vertebræ, and the first or first and second bone of the loins.

Various causes conduce to fracture here. Violent muscular contraction at the time of being cast for a surgical operation, or during the course of its performance, is one of the most common.

Some Continental veterinarians affirm that the accident happens in the fall, while others regard it as occurring during the struggles which follow. We are satisfied, however, that it occurs at both periods, but we are unable to say to which of these causes it is most frequently due.

Fracture of the dorsal and lumbar vertebræ has resulted from violent straining while being cast in the stable with the legs entangled in the tie-rope, and from a heavy load falling on the spine of old horses when the hind-legs suddenly slip from under them. To hunters and chasers it sometimes occurs as the result of jumping short and alighting with the hind-legs in a deep drain, or in the subsequent struggle to reach the bank.

Fracture of the vertebræ in the region of the withers or the loins may result from falling over backwards, and it has been said to have occurred in kicking, and also while galloping and in starting heavy loads.

Symptoms.—Pressure on the spinal cord from displacement of the broken fragments usually occasions paraplegia or paralysis of the hind-quarters. This result may come about at once, or it may be deferred for some hours or, rarely, days. Where pressure exists, the animal sinks to the ground and fails to rise. After it has done so, the hind-limbs are limp, and project straight out at right angles with the body. The muscles quiver, and patchy sweat appears about the thighs. In the animal's efforts to get up, the fore-end is raised, but the hind extremities are helpless and the quarters incapable of movement.

When pricked with a pin there is usually no response, behind the seat of fracture sensation as well as motion being paralysed. Where these symptoms are wholly present it may be reasonably concluded that fracture exists, but it must be understood that paraplegia or paralysis of the posterior part of the body may result from concussion of the spinal

cord, in which case there is a prospect of recovery. It is necessary, therefore, that a careful consideration be given not only to the symptoms, but also to the history of the case, especially with regard to its origin.

There are two diseases with which fracture of the vertebræ may be confounded by persons who have no practical experience of the subject.

These are "thrombosis", or plugging of the iliac arteries, and a disordered state of the blood termed "hæmoglobinuria", both of which are dealt with elsewhere.

Animals when suffering from the former ailment lose the power of motion behind after exertion, but it differs from fracture in the fact that the disablement soon passes away, and the animal rises to his feet and continues in apparent health until exertion is renewed, when the paralysis returns, and this may be repeated again and again for weeks and months.

In the latter disease the affected horse is attacked with sudden and acute lameness in one hind-limb, which sooner or later results in complete disablement and inability to stand. The respiration is hurried, and accompanied by an outburst of profuse sweating. With this the urine becomes dark or even black, like porter, and on being boiled shows the presence of large quantities of albumen. The symptoms above described serve to differentiate the two diseases from fracture of the vertebræ.

Treatment.—Where paralysis is due to concussion the injured animal should be provided with a deep straw bed, and be allowed to lie quietly for four or five days before any attempt is made to test his powers of movement. A dose of physic should be given at once, and hot cloths well wrung out applied over the spine. Returning innervation of the affected muscles will be shown by slight voluntary movement of the hind-limbs, which will increase day by day until an attempt is made to rise. This, however, should not be hastened by any pressure or encouragement to assume the upright posture, but everything should be done to induce the animal to remain recumbent. To avoid the formation of bed-sores, and minister to his general comfort, he must be carefully turned over from time to time, and friction vigorously applied to the region of the quarter will assist in bringing about restoration of power. As this appears, the administration of small doses of strychnia may be resorted to, and gradually increased as time goes on and the muscles regain their strength.

Where the vertebræ are fractured there is little hope of any benefit being derived from treatment, and the only alternative is slaughter.

FRACTURE OF THE BONES OF THE FACE

Fracture of the facial bones is not as common as might be expected considering the prominent and exposed position of the face. From time to time, however, such cases are brought under the notice of the veterinary practitioner as the consequence of external violence. The face is sometimes brought forcibly into contact with fixed objects, such as walls, trees, or lamp-posts, when horses run away, or it is struck by other horses while grazing, or brought into collision with various moving bodies. The jaw-bones are sometimes broken by becoming fixed on hooks, in chains, or in trappy positions.

FRACTURE OF THE FRONTAL BONE

This bone, forming a considerable area of the face, and arching over the eye, is much exposed, and sometimes suffers fracture from one or another of the causes referred to above.

The fracture may involve that portion of the face situated between the eyes, or the orbital process which arches over them. The importance of fracture of this bone, whether in the one part or the other, is centred in the degree of displacement which attends it. Fracture without displacement in either case does not give rise to any serious symptoms unless the blow is high up and the brain suffers concussion.

A little swelling and drooping of the eyelid, and a blood-shot condition of the mucous membrane of the eye with a discharge of tears, may be all that is to be seen when the orbital process of the frontal bone is broken without displacement. In these cases but little requires to be done. A mild aperient, bran diet, and cold-water irrigation of the part will suffice to keep down local inflammation and assist repair. Where, however, the bone is depressed the eye will at the same time have suffered more or less damage, and the sooner the displaced bone is lifted into its place again the better. This may be effected by the employment of a bone lever and gentle continuous upward pressure, after which irrigation with cold water and a dose of physic are all that will be required.

Fracture of that part of the frontal bone between the eyes invariably occasions more or less injury to the frontal sinuses whose walls they assist in forming, and as these cavities communicate with the nostrils some blood-stained discharge may flow from them. If the force producing the fracture has been very considerable more or less depression of the broken pieces will have taken place, and it may be that the bone has been broken into several fragments. Any displacement should be remedied at once

by levering up the depressed fragments. This will require that a small piece of bone shall be removed with a trephine from a suitable position outside the fracture area, and a lever properly padded at the point introduced into the opening and the depressed bone raised into its normal position. If the bone should be broken into small pieces replacement will be greatly assisted by manipulating them from the outside, while they are being raised by the lever from within. It may be that one or more of them will require to be removed. If so it should be done at once under strict antiseptic precautions; but it must be pointed out that since no muscles are attached here, and the bone is not exposed to any moving force, or called upon to support weight, there is nothing to occasion displacement when once adjustment of the broken parts has been effected.

Hæmorrhage into the frontal sinuses is a common result of fracture of this part of the frontal bone, and should the operation of trephining be called for an opportunity will then be afforded for washing out the blood, for which a tepid antiseptic solution should be employed.

Chronic disease of the bone is an occasional consequence of this accident, and must be dealt with according to the indications of the case.

FRACTURE OF THE LOWER JAW

Fracture of the lower jaw may take place through the neck of the right branch or the left, or both. It may proceed vertically through the body and divide or separate the two branches from each other. It may pass transversely through the body of the bone behind the incisor teeth, or it may detach the styloid process, or sever the condyle from its branch, and in various other ways the bone may be chipped or broken.

External violence in one or another of its many forms is accountable for this mishap, to which in rare instances the bone is predisposed by disease. Kicks from other horses, falls, and collisions are the more common causes, but it sometimes results from the teeth becoming fixed in narrow spaces, and from the careless use of the gag while performing dental and other operations on the mouth and throat. In young colts, the parts of whose bones are not yet firmly united together, one branch is sometimes partly or completely torn away from the other through their connection at the body. At the same time the central incisor teeth alone or together with others are loosened, and perhaps also more or less displaced.

Symptoms.—In vertical fracture through the body of the bone there is at first considerable flow of saliva from the mouth. The lower lip is

constantly being moved sharply up and down, and in gathering his food the animal breaks off abruptly. If there is much displacement mastication is interfered with, and the food is dropped from the mouth. The lips remain somewhat separated from each other, and on opening the mouth the mucous membrane will be found to be torn or placed on the stretch by the parting pieces, or not, according to the presence or absence of displacement and the extent to which it has proceeded.

When the breakage occurs across the body of the bone behind the incisor teeth, the chin is more or less depressed, the mouth remains open, allowing a free escape of saliva and maybe more or less protrusion of the tongue. Crepitation is perceived when the broken parts are moved one upon the other. In consequence of the pendulous and disabled state of the lower lip the patient fails to gather his food, or if he succeed it is in a very small measure, and only accomplished with great difficulty and at the expense of much suffering.

In fracture of the coronoid process the angle of the jaw on the side of the injury will be found to be slightly lower than the opposite angle. Mastication is seriously interfered with, and the movements of the jaw lose their natural swing and become restricted and irregular. The animal cannot masticate hard food, and will only take aliment of a soft and sloppy character.

Fractures through the neck of the jaw between the molar teeth and the tusk, without displacement, are sometimes difficult to identify at first, the only symptoms observable being a marked shyness in feeding, in the act of which the saliva becomes churned into foam.

Presently, however, a diffused swelling appears around the bone over the seat of the fracture. This may encroach upon the "mental" nerve as it escapes through the foramen on the outer side of the bone at this part, and for a time partial paralysis of the lower lip is likely to result. If the broken parts are displaced a crepitus or rubbing sensation may be excited by moving one part upon the other.

Treatment.—Where displacement exists the parts should first be brought into their natural position and retained there by suitable means.

If the body of the bone be split vertically through the centre and the parts are displaced, they may be brought into position again by seizing the corner incisor teeth between a pair of large pincers and steadily but forcibly pressing them together. If they are raised one above the other, they must first be brought into line by depressing one piece or raising the other, as the case may be. If this cannot be effected by the hands, the pincers properly padded must be employed.

Should the teeth have undergone any displacement they must be

properly readjusted, after which the broken bone may be fixed in position by means of copper wire or whip-cord tied round the incisor teeth.

To guard against displacement the patient must be made to stand in the pillar reins, and for two to three weeks his food should be soft and sloppy, such as scalded bran and chaff, boiled roots, &c.

In fracture of the branches or the body of the lower jaw the cradle designed by Mr. Walker of Bradford, shown in fig. 333, may be used, or a piece of gutta percha, first soaked in hot water, should be moulded on to the under surface and sides of the lower jaw, and made to fit into the hollow (intermaxillary space) between its branches. By then punching four or five holes through the front border on either side, and one or two into the upper border, it may be made secure by strings or straps passing in front of the face and behind the ears.

Mr. Walker's cradle is composed of two lateral portions, fitting to the sides of the face, suspended from behind the ears by a padded strap A, and kept in position by a brow-band B, throat-strap C, and jaw-straps F F F F, with a central portion of wood padded with leather D, to fit between the branches of the jaw, and two flanges E E to rest on the first molar on each side of it, the side plates having an arrangement for adjusting their length and screws H H for clamping them when adjusted. In order that the flanges should have a level bearing and allow the animal to eat, the first molars on which they rest must be shortened by tooth shears (fig. 334) or rasp (fig. 335). The apparatus should be so adjusted as to lie evenly and without pressing more on one part than another.

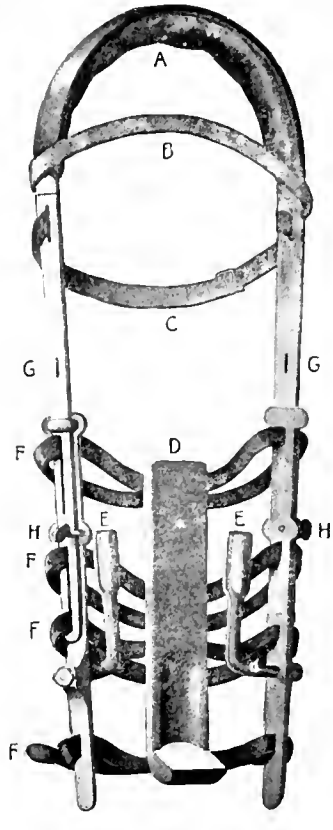


Fig. 333.—Walker's Face-Cradle

A, Padding to protect Poll. B, Brow Band. C, Throat Lash. D, Pad for submaxillary space. To be made of wood and well padded with leather. E, E, Flanges to rest on first molars. F, F, F, F, Straps passing under lower jaw. G, G, Supplementary Strap Slits. H, H, Thumb-screws for lengthening or shortening the plate: designed by Mr. Broad, Bath.

In the absence of these appliances an adhesive compound of Burgundy pitch, Venice turpentine, and a little bees'-wax may be plastered over and round about the seat of fracture in a succession of layers until a thick strong covering has been obtained. This when set will give considerable support to the broken parts.

Where both branches of the jaw are fractured Fleming recommends that the space between them be completely filled up by a large firm pad of tow impregnated with an adhesive mixture, then one bandage after another (covered with the resinous mixture) applied around the jaw,

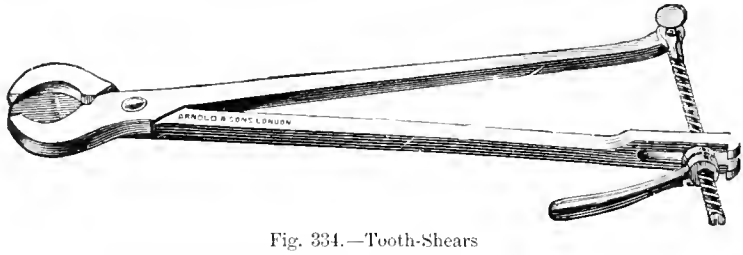


Fig. 334.—Tooth-Shears

face, and nose. These, when the mixture has hardened, act as a cradle. The animal may be allowed to drink thick, nutritious gruel out of a wide shallow vessel, or the gruel may be injected into the mouth or

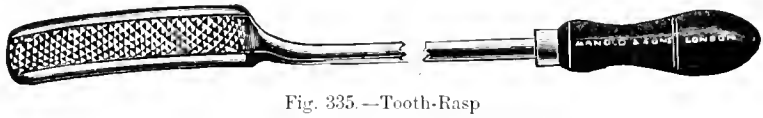


Fig. 335.—Tooth-Rasp

rectum or both. The standing position (for the horse) must be maintained, and attention be given to the retaining apparatus that it be not displaced nor cause abrasion.

FRACTURE OF THE ANTERIOR MAXILLARY BONE

The most common form of fracture of this bone is that in which it becomes broken away from its fellow at their joining, and displaced either to one side or in an upward or downward direction. Fracture through the body or the nasal process may occur, but these forms are comparatively rare.

Kicks, blows, and falls on the mouth are accountable for many cases of this mishap, and in several instances the writer has seen the bone torn from its fellow in the struggles to remove the incisor teeth from some confined position, such as when fixed in an iron ring or between a hook and the wall of the stable.

Symptoms.—Some distortion of the face on the side of the fracture, in which the upper lip is either raised or depressed or drawn to one side, is usually present when displacement takes place. There is some discharge of saliva from the mouth for a while, and frequent movement of the lips.

When the body is broken across, the fragment containing the incisor

teeth is movable and emits a crepitus. When the body of one bone is broken away from the other the displaced portion may be firmly fixed in an upward, downward, or outward direction. If, as sometimes occurs, it is also broken across, then it will be freely movable.

Treatment.—The simplest form of fracture, and the one most amenable to treatment, is that in which one bone is torn away from the other. In this case replacement may be effected by means of a little pressure and manœuvring with the hand, or it may require the use of a pair of large pincers, as already prescribed for the lower jaw, to bring the displaced part into position.

Broken teeth must be removed, and any that may be found to be pushed out of place should be properly restored to their natural position.

Any bits of bone that may be loose and detached must be taken away. If allowed to remain, their presence will excite irritation and pus formation in the surrounding tissues and retard reparation.

The broken fragments may be retained in position by copper wire bound round the incisor teeth.

During the first forty-eight hours the patient should be kept exclusively on thick gruel, and afterwards on sloppy bran diet, other forms of aliment being gradually added as the case progresses.

It is desirable to keep the horse in pillar reins for a short time after the parts have been readjusted.

FRACTURE OF THE BONES OF THE FORE EXTREMITY

FRACTURE OF THE SCAPULA OR BLADE-BONE

Fracture of the scapula is fortunately of rare occurrence, partly because it is covered with thick muscles and rests on others on the elastic chest wall, partly also because its movements are of limited extent, and in some degree also on account of its out-of-the-way position.

Sudden and violent blows are the chief cause by which fracture of this bone is brought about. When occurring at the upper angles there is some prospect of recovery, but fracture of the body of the scapula, or the neck, or the articular cavity can hardly be viewed otherwise than as a dangerous condition. Splints and bandages cannot be applied with the same restraining influence on movement which they afford when applied to those bones which are below the elbow and away from the trunk.

The symptoms displayed in scapula fracture are very vague. Crepitus is always difficult to develop and in most cases impossible. The bone does not lend itself like the lower bones of the limb to the required manipulation

of its broken parts, but where the fracture occurs at the neck pressure at the point of the shoulder, when the leg is raised from the ground, may cause it to appear.

Some swelling will arise about the seat of the injury, and pain will be evinced in response to deep pressure on the part. Forward movement of the leg is effected with some difficulty, and weight imposed upon it causes severe lameness.

Where displacement occurs it is most difficult to bring the broken parts into position again, and when they are so adjusted it is practically impossible by any bandage or splints or other means to maintain them there. All that can be done is to support the patient in slings and leave the rest to nature.

FRACTURE OF THE HUMERUS

The humerus or upper arm is seldom broken. The large muscles which everywhere enclose it serve as a protection against external violence.

When this fracture does occur, and the breakage extends through the body of the bone, but little difficulty is experienced in the diagnosis.

The limb below the fracture displays unusual mobility. It is incapable of supporting weight, and when the animal is made to move, acute pain and lameness are evinced. The part is much swollen, and by carefully fixing the upper segment of the bone, and moving the lower one, crepitus may be developed

Sometimes the external condyle is broken off, and the extensor muscles, losing their fixed point of action, and being at the same time more or less damaged, fail to antagonize the action of the flexors. As a consequence the leg is drawn inwards and the foot and pastern are flexed on the canon in such a way that the front of the hoof rests on the ground.

When the inner condyle is fractured and the attachment of the flexor muscles becomes weakened, the action of the extensor muscles, overpowering them, draws the foot forward, while the knee, losing its support from behind, falls backward. When weight is imposed upon the damaged leg, this backward inclination of the knee becomes more marked and the concavity in front of the limb is increased.

Treatment.—When the shaft of the humerus is fractured there is not much hope of restoring the animal to a state of usefulness for ordinary physical labour. Where it is of special value for stud purposes an attempt should be made to effect re-position and bring about reparation.

The arm is a difficult place on which to apply a splint, and equally so to adjust a bandage with any prospect of its being retained. We would

therefore advise that the patient be placed in slings, and that the ground be slightly hollowed out to receive the foot of the broken limb. A starch bandage must be applied from below the knee to the middle of the arm, and a thick pitch plaster round the humerus. With this, quietude must be enjoined, and the requirements of the patient supplied without disturbance.

FRACTURE OF THE ULNA

The prominent position occupied by the ulna predisposes it to fracture beyond that of some other bones of the extremities. The olecranon, which forms the point of the elbow, is more especially the seat of fracture in the horse. Here the breakage may occur deep down in the elbow-joint, or the summit of the olecranon may be broken away, leaving the joint intact. In whichever position the fracture may be, but little can be done to bring about reunion of the parts, and should it by any chance be effected in those cases where the joint is involved, the animal will always remain a cripple.

The causes which give rise to fracture of this bone are mainly kicks and blows, and on one occasion the writer has known it to occur in an animal while pulling up suddenly to avoid a collision when going at great speed.

Symptoms.—In these cases the limb is brought forward with the knee in a semiflexed condition, and the elbow is depressed. Any attempt at progression is marked by considerable downward inclination of the fore-quarter on the injured side. This attitude results from the great triceps muscle having pulled the broken point of the elbow upward and ceased to give support to the limb, while the biceps and the mastoido-humeralis, having now nothing to antagonize their action behind, draw the limb forward beyond its natural limits.

The pain and distress caused by this mishap are always considerable, and progression is marked by great difficulty in bringing the leg into an upright weight-bearing position. When the elbow-joint is involved, the suffering is much increased, and general enlargement of the articulation soon appears.

Immediately after the accident the detached piece of bone can be felt to move, and the space dividing it from the other portion may be recognized, but owing to the upward displacement it is seldom that crepitation can be induced.

Treatment.—Nothing can be done to bring the broken pieces together and maintain them in position, and there is little hope of any good resulting from treatment.

If it should be decided to do anything, we would advise the simple course of slinging, after the whole limb has been straightened and put into a starch bandage.

FRACTURE OF THE RADIUS

Fracture of the radius, or fore-arm, like most other fractures of the bones of the limbs, is the result of kicks and blows, or false steps, or it may arise in the struggles to recover the leg from some fixed position. A blow on the inner side of the bone, where it is least protected by muscles, is more likely to occasion a fracture than one on the outer side or back of the limb.

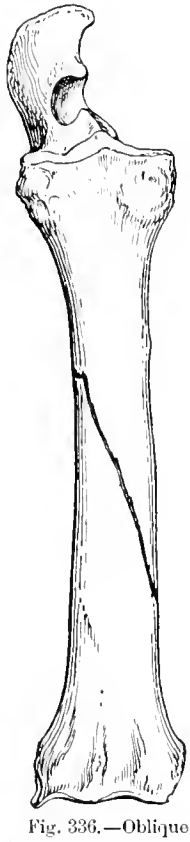


Fig. 336.—Oblique Fracture of the Radius

Symptoms.—An incomplete fracture of this bone, without displacement, affords no other evidence of its existence than local pain and swelling, with more or less lameness, and in this form of injury recovery may be looked forward to under proper treatment, and the same may be said of complete fracture when the broken parts continue to hold together.

It is when the broken fragments are separated that the case reaches its more serious aspect.

Here the animal fails to bear any weight upon the limb, and locomotion becomes impossible. The leg below the fracture displays abnormal mobility, and when raised from the ground swings forward and backward and bends from side to side. Crepitation is readily detected, and the part is swollen, hot, and painful to the touch.

Treatment.—If the animal is young and docile, and the tissues in the region of the fracture have not been seriously damaged, and the parts are promptly brought together, reparation may possibly be effected. The chances, however, are too often in favour of the contrary result; and even in the majority of those cases in which a reunion is effected, some deformity, or other equally serious defect, remains behind.

It is only, therefore, in animals of considerable value that treatment is likely to be remunerative where successful. Since quietude is one of the first requirements of treatment, the patient must, as soon as possible, be placed in slings, and if a properly-constructed operating-table is not at hand, whereon chloroform may be given, a dose of morphia will have the effect of rendering him more manageable during readjustment of the broken

bone. Before the bandages and splints are applied it is most essential that the leg be brought into its natural position. The toe and the knee should be in line, and there should be no deviation either to the right or to the left in the course of the fractured bone.

A series of bandages soaked in a mixture of the white of egg and starch should be applied up the leg from the coronet as far along the arm as it is possible, and then the iron splint designed by Bourgelat (fig. 337) should be adjusted over them. Of course the hollow of the heel and all other depressions in the course of the limb will be filled in with tow, so that the pressure of the bandages may be equalized. Should no such splint be accessible, then wooden splints cut to the form and length of the limb must be employed.

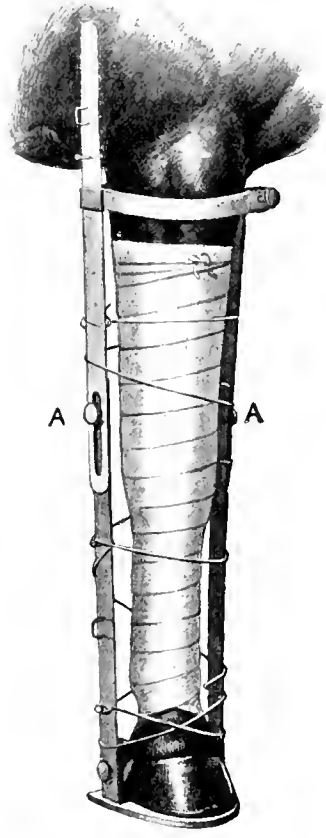


Fig. 337.—Iron Splint for Fractures of the Fore-limb

A, A, Screws for adjusting the length of the Splint.

FRACTURE OF THE KNEE-BONES

This is comparatively rare. When it does occur it is mostly associated with broken knees, and assumes the form of a compound fracture, complicated with inflammation of the joint and damage to tendons which pass over it.

Fractures here are attended with great pain and suffering and much constitutional disturbance. There is free discharge of synovia or "joint oil", inability to support weight on the affected limb, and considerable swelling. In other than animals of considerable value for stud purposes the result of treatment, however successful it may be, will not be such as to compensate for the time and trouble which these cases demand. The knee invariably suffers irreparable damage, and the animal remains a cripple for the rest of his life.

Where treatment is resorted to, the horse must be placed in slings, and splints and bandages employed to maintain the joint in a state of rest, while at the same time provision should be made in the bandaging for the free discharge of matter from the wound in the knee, which must be treated on antiseptic principles.

FRACTURE OF THE METACARPAL BONES

In adult and aged horses the metacarpal bones are generally united together by ossific union, and it results from this, when fracture occurs, that all the bones are involved in it. In colts, where they are united by ligaments only, each one of them may be broken independently of the others, but such an occurrence is very occasional.

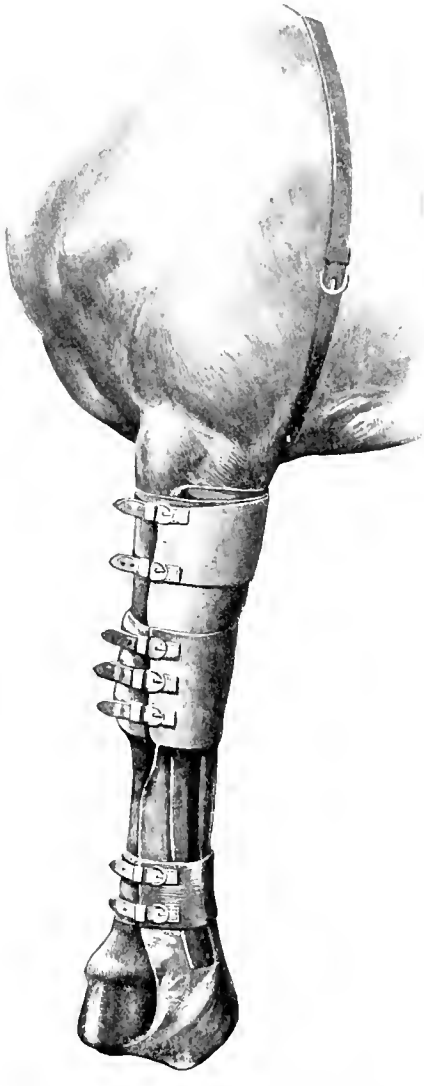


Fig. 338.—Splint for Fracture of the Metacarpal Bones

Fracture of these bones (fig. 326, p. 222) is mostly brought about by kicks, jumping into deep hard roads, blows against fences and walls, and slips, &c.

The absence of muscles in this region, and the opportunity thus afforded of a clear view and thorough manipulation of the part, renders diagnosis an easy matter when displacement has occurred. The bone will be seen to bend at the seat of fracture when any attempt is made to put weight upon it. In progression, that part of the limb below the breach has ceased to be under control, and swings about as the body moves forward. Crepitus can be readily produced, and the existence of a fracture becomes at once apparent.

Treatment.—Although these cases are both difficult and uncertain, now and again treatment has its reward in restoration to a state of usefulness, but it is seldom possible to avoid depreciation in the value of the animal. To what extent this factor will assert itself will depend very much upon the degree of displacement and the damage inflicted upon surrounding tissues by the unrestrained movement of the broken fragments after the accident.

Fractures without displacement, when they are diagnosed and promptly

treated by slinging and suitable splints, offer the best prospects of success.

Where displacement occurs, the bone must be set, and in carrying out this part of the work every care will require to be taken that the fragments are brought into their proper position. Before splints and bandages (fig. 338) are applied, the knee and the toe must be brought into line, and the leg as a whole rendered straight. Placed in slings, the patient must be disturbed as little as possible, and careful watch kept over the limb, so that prompt relief may be given by relaxing the bandages where undue pressure provokes swelling.

Should this precaution fail to be observed, the case will become complicated by dangerous sloughing, and the reunion of the bone retarded or altogether prevented.

FRACTURE OF THE OS SUFFRAGINIS OR LARGE PASTERN

Fractures of the large pastern are perhaps the most common of all affecting the limbs of the horse.

They mostly take an oblique direction, extending from above downwards towards the outer or the inner side (fig. 339), or pass vertically downwards from the upper to the lower extremity. Less frequently the breakage is transverse, in which case it mostly occurs towards the lower extremity (fig. 340), and is very frequently comminuted.

Fig. 339. Oblique Fracture of Suffraginis

In oblique fractures the division usually extends into the fetlock joint, while in those taking a vertical course it may also involve the joint formed with the small pastern. In young horses they are most frequently partial, and take the form which is commonly termed "split pastern". In these cases there is no displacement, and treatment is thereby favoured.

Fracture of this bone is most commonly met with in race-horses, hunters, and chasers. In the first it results more especially from slips, false steps, twists, and striking the toe in the ground while going at great speed. In hunters and chasers it also occurs as the result of jumping into roads or travelling through deep holding-ground, or dropping the feet into holes.

Symptoms.—Following the mishap, there is sudden and severe lameness. If the fracture is comminuted or attended with displacement the leg is held in the air, and is incapable of bearing weight.

If the foot be rotated or forcibly flexed on the fetlock, crepitus or rubbing of the broken pieces will be felt. Great sensibility to pressure along the surface of the bone soon appears, accompanied by a firm diffused swelling. In split pastern the lameness, although sometimes considerable, is less severe, and there is usually no crepitus. The swelling may be inconsiderable, and the existence of a fracture altogether overlooked.

Treatment.—No time should be lost in placing the animal in slings. The shoe should be removed, and the stable littered with 3 or 4 inches of saw-dust or peat-moss. If there is no displacement, which will be readily determined by the undisturbed outline of the pastern, a starch bandage should be applied at once. In making the application, the hollow of the heel should first be filled in with a pad of tow, over which the bandage should be rolled and carried over the fetlock joint from the coronet, nearly as high as the knee. In those cases in which displacement occurs, the parts should be readjusted and the bone supported by a starch bandage or some more suitable splint.

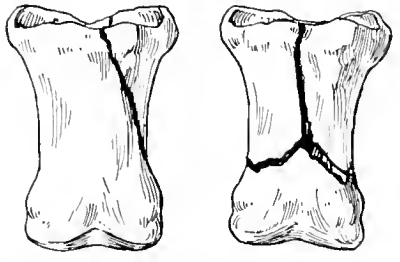


Fig. 340.—Oblique and Transverse Fractures of the Os Suffraginis

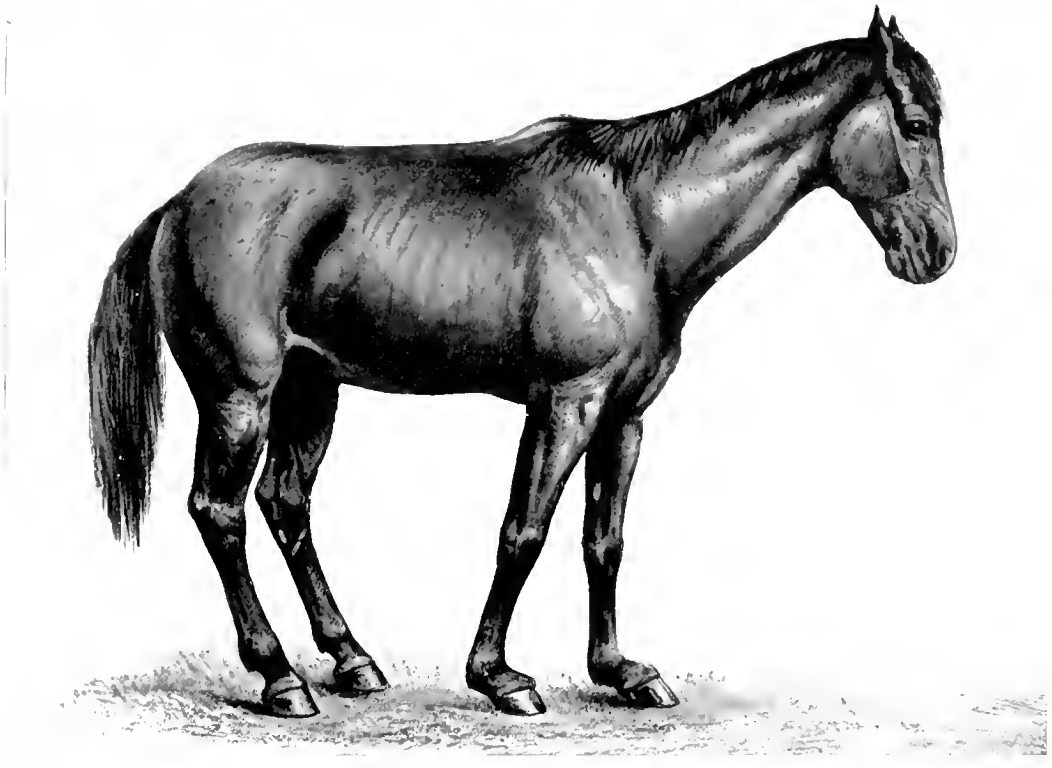
A light, spare diet should be prescribed, and a little linseed-oil may be incorporated with it night and morning until the bowels are gently acted upon. All that is now needed is to avoid any sudden excitement, and to keep the animal perfectly quiet.

So soon as he begins to throw his weight upon the limb, and to continue it, the bandage may be removed. More or less enlargement will be found to have developed on the bone in the form of a reparative callus, and subsequent treatment must be directed towards effecting its reduction. For this purpose a repetition of blisters must be applied over the part during a continuance of rest. In some cases a large ring-bone, with more or less lameness, remains as a permanent result of the fracture, while in others but little enlargement follows, and the action is in no respect affected by it.

FRACTURE OF THE SESAMOID BONES

Fracture of the sesamoid bones is by no means of uncommon occurrence. It happens most frequently in old hunters and chasers when carrying heavy weights over deep ground, and mostly at the end of a long and tiring run.

The line of the fracture is usually transverse. Sometimes the accident is confined to one bone, but more frequently it involves both, and now



OSTEOPOROSIS

Showing Disease and Descent of the Sesamoid Bones

Photo by W. Hall Green, Brighton

FRACTURE OF THE SESAMOID BONES

Border Lass, aged, broke down (fractured the sesamoid bones of both forelegs) at Ringmer Steeplechase, April 10, 1889. Photograph taken seven weeks later

and again it occurs to both fore-limbs at the same time. The bone may break through the middle, or a piece of the upper angle only may be torn away from the rest. The fracture sometimes follows upon repeated chronic sprain to the suspensory ligament, and there is reason to think that in these cases the cohesion of the bone has been diminished by an extension of the inflammatory action from the ligament to the bone to which it is attached, for it frequently occurs that prior to breakage the sesamoid bones have been for some time more or less enlarged. Slipping and false steps in making sharp turns are sometimes accountable for this injury.

It has been said that "the accident is quite as likely to happen while the horse is at rest in his stall as *under any circumstances*"; but while granting the possibility of such an occurrence, we cannot subscribe to a statement for which experience affords no sort of support. We have repeatedly known horses which have been laid up for some time on account of lameness in the fetlock joint, in which perceptible enlargement of the sesamoid bones existed, to fracture their bones in the stable, or very soon after renewing work, but we have always regarded such cases as having been predisposed to fracture by a process of rarefaction of the bones arising out of inflammation extending from the sprained ligament.

Many cases of what is called "breakdown", if carefully examined after death, would be found to result from a giving way of the bones in this weakened condition, and the removal of a fragment by the partially-separated ligament (Plate XXXIX).

These cases are attended with lameness more or less severe, but in the slighter accidents there may be but little distortion of the fetlock joint, and the writer has found that in course of reparation the ligament at its point of attachment with the sesamoid bone becomes ossified.

Fig. 341.—Fracture of the Sesamoid Bones

1, Carpal tendon cut away to show suspensory ligament. 2, Small metacarpal bone. 3, Suspensory ligament. 4, Branch of same. 5, Fractured sesamoid bones. 6, Deep sesamoid ligament. 7, Superficial sesamoid ligament. 8, Intersesamoid ligament.

Symptoms.—Fracture of the sesamoids results in sudden lameness, but in degree varying with the nature of the fracture. When this is

completely across the bone, the broken fragments are forced asunder by the weight imposed upon them, and the fetlock joint, having lost the support of the suspensory ligament, sinks towards the ground. The weight, now falling more directly upon the heel, gives the toe an inclination upwards. This deformity may not occur immediately, and sometimes only appears two or three days after the accident, at which time there is much swelling, heat, and pain in the part. It may be that only one sesamoid bone may be fractured, in which case the fetlock joint inclines inward or outward, according as the one side or the other is affected. Although the broken pieces may be much displaced, crepitus may sometimes be induced by fixing the suspensory ligament above and forcibly flexing the fetlock joint.

Treatment.—Very little can be done in these cases to fit the horse for remunerative work, but when it is required to put it to the stud, in some cases it may be made serviceable for the purpose.

The strain should be taken off the suspensory ligament by the application of a high-heeled shoe. The joint should then be supported by a starch bandage, carried from the coronet upwards to the middle of the canon. This having been done, the animal should be placed in slings and kept there eight or ten weeks, or longer if necessary, as quiet as possible.

In complete fracture, the fetlock joint is sure to remain deformed and enlarged to a greater or less extent. A repetition of blisters after the patient has been taken out of the slings will help to reduce the enlargement, and give further tone to the injured parts.

FRACTURE OF THE NAVICULAR BONE

The frequent occurrence of navicular disease, as a result of which the bone becomes weakened by ulceration and rarefaction of its tissue, renders the bone in question peculiarly liable to fracture, and this predisposition is still further increased by the position which it occupies, and the weight and concussive force to which it is exposed during locomotion.

It is, however, more particularly in horses the nerves of whose feet have been divided that the accident occurs. While the nerves are intact, and sensation exists in the feet, the animal relieves himself from pain by throwing the weight of the body on the front of the foot, but when sensation has been removed by division of the nerves, pain disappears. The heels are then brought to the ground, and the navicular bone, weakened by disease, is made to bear the full weight and impact of the body.

At this time the perforans tendon has undergone more or less

excoriation and inflammatory softening, and failing in consequence to give the bone support, a fracture results. It is no uncommon thing for rupture of the tendon to follow upon fracture of the bone.

Nails penetrating the frog have been noticed to cause fracture of this bone, but such an occurrence is very rare indeed.

Symptoms. — Evidence of fracture of the navicular bone is difficult to differentiate from that severe inflammation of the navicular joint and tissues of the foot which sooner or later follows upon neurectomy. A little

Fig. 342.—Fracture of Navicular Bone

A, Cretification of Superior Navicular Ligament.
B, Diseased Bone.

Fig. 343.—Fracture of the Navicular Bone

fulness in the hollow of the heel is first observed, which on pressure is somewhat yielding, and suggests the existence of deep-seated fluid. The toe has a slight inclination upwards, and the fetlock joint is somewhat depressed. Soon the coronet exhibits an abnormal fullness, and oozing of serosity appears between hair and hoof. The coronal thin border of the latter becomes white by saturation with serosity, and the horn commences to separate from the skin, and soon the hoof sloughs, a result which sooner or later follows upon fracture of the navicular bone.

Of course nothing in these cases can be done with any prospect of cure, and the better and more humane measure is to have the animal destroyed.

FRACTURE OF THE RIBS

Having regard to the large and exposed surface formed by the back ribs, and the peculiar occupation and surroundings of the horse, fracture of the ribs is much less common than might reasonably be expected.

Fig. 344.—Oblique Fracture of Rib (third rib, right side, outer aspect)

If the front ribs are protected against external violence by thick muscles, and also by the scapula or shoulder-blade, those behind are possessed of great elasticity, and, having no fixed attachment below, are much more capable of yielding to external force without breaking than those in front. Both, however, are now and again forced beyond their powers of resistance, and a fracture follows. This may be transverse, as in fig. 337, oblique (fig. 344), or vertical, with or without displacement. The displaced fragment, if directed inwards, may puncture the pleura or the lung, thus inducing complications of pleurisy or pneumonia, or both, or it may pass through the skin and convert a simple into a compound fracture.

Both these events add very materially to the danger of the case, and too often give it a fatal turn.

Causes.—Fracture of the ribs is usually the result of external violence. Sometimes a kick from another horse, at others a collision with the shaft of a trap, or the pole of a coach or brougham, will cause it; at others it results from a fall on a hard surface, where the legs slip from under the body and the ribs strike the ground first and without any break in the fall.

Symptoms.—Fractures of the ribs frequently occur without displacement, and undergo repair without interference of any kind. In these cases there is nothing to be seen outwardly, and, excepting a slight thickening over the line of fracture, there is nothing to be felt. The part is tender to touch, and deep pressure causes the patient to recede from it and to emit a subdued grunt. Tenderness may be found to exist on neighbouring ribs, and some stiffness will be observed in turning.

Where the broken parts are displaced or contused, more or less swelling appears over the site of fracture. By following the ribs downwards with the fingers before this occurs, the breakage will be recognized as an irregularity in its continuity, with more or less projection of one of the broken

segments from the general surface. With this will be associated great soreness at and about the seat of injury.

The fracture may be complicated with perforation of the chest or an external wound. In the former case pleurisy of a local or general character will be excited, or should the lung be punctured or torn, as sometimes occurs, signs of pneumonia will be present, or both may exist together. In these cases the breathing will be more or less disturbed, accompanied by cough, and the more serious symptoms incidental to disease of the chest. An external wound connected with traumatic injury to the pleura and lungs is a serious complication, and one which is invariably attended with the greatest danger.

Where the broken ends of the bone are sharp and cutting, the intercostal blood-vessel may be divided and give rise to hæmorrhage.

In fracture of the front ribs severe lameness of the fore-limb on the side of the injury is of common occurrence. This would seem to result from the movement of the broken bone by the serratus magnus muscle, which not only enlarges the chest in the act of inspiration, but supports the trunk as in a sling (fig. 44, Vol. I) between the fore extremities.

Treatment.—In cases of simple fracture, without displacement, it is good practice to place the animal in slings for a fortnight or three weeks, and then provide him with a good straw bed and keep him quiet.

Where displacement has occurred, by which the lung is interfered with, it might be necessary to attempt re-position notwithstanding that the operation is attended with considerable danger.

For this purpose an incision will require to be made over the seat of fracture. The finger or a suitable lever must then be carefully introduced and brought to bear on the inner side of the front edge of that portion of the bone whose point is directed inwards, and when the chest expands in the act of breathing an attempt should be made to bring the displaced fragment into position by pressing it outwards.

Before proceeding with the operation the hair should be closely clipped off the part, and the skin thoroughly washed with soap and water, and then well irrigated with carbolic or some other antiseptic solution. Instruments should also be disinfected, and the wound subsequently treated antiseptically.

If the displacement does not interfere with the lung, it is not desirable to interfere with it. Time and a period of rest in slings is all that can be done to effect a union.

Where a wound is produced at the time of the fracture, advantage should be taken to rectify displacement, if such exists, by the method above described under antiseptic precautions.

FRACTURE OF THE PELVIS

The large size of the pelvis, its projecting angles and position, render it specially liable to fracture, and modern road-making in our large towns contributes not a little to this result. Wood pavement, when the surface is first moistened with water, is rendered difficult to travel over at any time, but with heavy loads behind them, where the ground is on the ascent, or slopes, as it usually does, from the centre towards the sides,

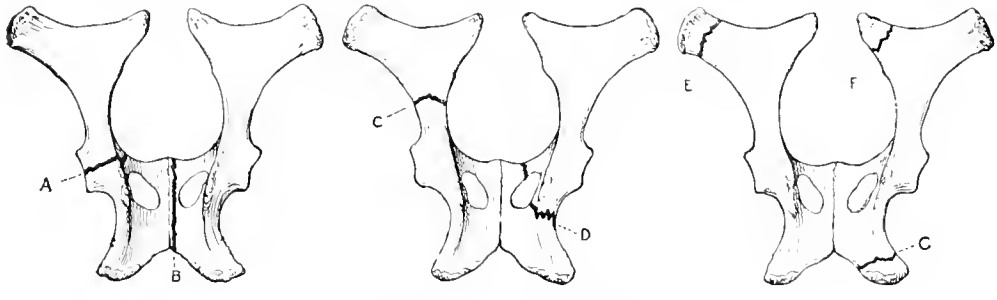


Fig. 345.—Fracture of the Pelvis

A, Fracture through the Cotyloid Cavity. B, Fracture of the Symphysis Pubis. C, Transverse Fracture of the Os Pubis. D, External Fracture of the Ischium. E, Fracture of the External Iliac Angle. F, Fracture of the Internal Iliac Angle. G, Fracture of the Tuberosity of the Ischium.

heavy horses frequently fail to keep their legs, and suffer fracture of this bone by a heavy and helpless fall. When the fall is on the side, and the force is applied to the point of the haunch, a portion of the angle of the ilium may be broken away from its body, or the fracture may take place in some remote and deeply seated part. Draught-horses, when moving heavy loads in two-wheeled carts, are sometimes brought to the ground by their hind-limbs suddenly slipping away from them right and left, when the pelvis is forced to the breaking-point by the weight of the load on the one hand and the struggles of the animal on the other.

Blows on the hip while passing at high speed through doorways and gates, or by collision with some other fast-moving body, are also accountable for accidents of this kind, and in rare instances fracture has been brought about by "casting", or in the course of a surgical operation. In the hunting-field and the chase, horses have fractured their hips while jumping, as well as by dropping the hind-quarters into a drain as the result of failure to clear a bank.

From these and other causes fracture of the pelvis may take place in one or another of its various parts. Breakage of the point of the haunch (*hip down*) is the most frequent form which the accident assumes. Less frequently the body or the neck of the ilium may break, or the pubis or

ischium which form the floor of the pelvis, or the bony cup (*acetabulum*) which is engaged in forming the hip-joint, or the breach may take place through the tuberosity of the ischium where it forms the point of the buttock. Of course more than one of these several parts may be rent at the same time.

Symptoms.—Many and various phenomena result from fracture of the pelvis, and veterinarians have attempted to assign to each particular fracture its special set of symptoms, but it cannot be said that they have yet established a reliable code. The physiological disturbance which results from the fracture of any particular part of the pelvic girdle is sometimes so masked and disturbed by injuries occasioned to neighbouring muscles that the symptoms of no two cases of the same fracture sufficiently resemble each other to ensure correct diagnosis unless the fracture can be localized by the hand through the rectum.

Sudden lameness, more or less severe, according to the seat and nature of the breakage and the extent of displacement, is the immediate effect of the mishap; or the animal may be so far disabled at once as to be unable to rise when down or to stand when up.

In some cases there is obvious deformity of the quarter. In fracture of the neck or the inner angle of the ilium the croup becomes depressed, and when compared with the sound side, while weight is on the leg, it is noticed to be distinctly lower. Fracture of the outer angle of the ilium gives the quarter a flat appearance on the side of the injury, owing to the broken piece having been pulled downwards by the muscles attached to it. This is soon recognized by inspecting the quarters first from before and then from behind.

When the outer branch of the ischium is fractured, there may be more or less swelling in the region of the hip-joint and about the inner and back part of the thigh.

In fracture of the pubis, swelling of a diffused character appears sooner or later between the thighs, about the sheath and scrotum in the horse and the mammary gland in the mare. It may also extend in a forward direction beneath the belly, or in a backward direction to the perineum in the male or the vagina in the female.

Excepting in fracture of the outer angle of the bone (*hip down*) locomotion is very materially interfered with, and the power to bear weight is either seriously impaired or altogether destroyed.

In progression the limb on the side of the fracture may be moved unduly outward (abducted) or inward (adducted), or the animal experiences difficulty in bringing it forward or in raising it from the ground. The horse fails to walk straight but moves diagonally with the rump

inclined towards the sound side. In some fractures, especially those involving the acetabulum or hip-joint, pain is expressed by a more or less audible grunt, by spasmodic twitching of the muscles, and an expression of anxiety and fear. Where the round ligament (fig. 358) is in part or wholly detached from its connection with the cup, the limb ceases to be altogether under muscular control. In any attempt to move it, either the foot goes beyond or falls short of the point it is intended to reach. In one step it is thrown outwards, while in the next it may incline inwards, and the movement of the limb generally is limp.

The diagnostic symptom in this, as in all other fractures, is the presence of a true crepitus or impression which rubbing of the broken pieces together conveys to the hand or the ear.

This may be at once evident on manipulation, or auscultation, or only detected after much careful manœuvring of the limb of the animal, or it may be altogether absent. In order to bring it about, an assistant should be instructed to move the leg carefully in various directions, inwards, outwards, backwards, and forwards, and to rotate it gently first in one direction and then in the other. During this time the hand or the ear of the examiner should be applied to the point of the ilium, and moved backward from place to place to the point of the buttock, the mind being at the same time concentrated upon it. The hand should then be passed into the rectum and brought into contact with every available part of the pelvis. Any crepitus occasioned by the movement will then be felt, and any swelling or displacement of the broken pieces at once recognized. Crepitus may sometimes be induced and recognized by pushing the animal over from one side to the other, while still keeping the hand on the quarter or in the rectum. The absence of crepitus and severe lameness does not always indicate the absence of fracture, but may be the result of no displacement of the broken bone having taken place.

In these cases of doubt the examination should be repeated day by day for several days, during which the patient must be kept perfectly quiet.

Treatment.—The broken pelvis does not lend itself to those measures of mechanical restraint which are employed so successfully in dealing with some of the bones of the extremities, and we are therefore restricted in our endeavours to effect reparation to the device of slinging and maintaining as nearly as possible an upright posture, thereby avoiding those disturbing efforts involved in lying down and rising again, movements which are sometimes attended with most disastrous results.

Whether treatment is likely to be attended with success or not is a question which the examiner must answer for himself after having made a searching examination.

Generally it may be said that, owing to the very imperfect control which can be exercised over the movements of the horse, and the disturbing effect of the weight of the body acting on the broken bones while in the upright posture, but little can be hoped for from treatment.

In fracture of the acetabulum there is only a very remote prospect of a reunion of the broken pieces being brought about, and much the same may be said of a breach in the floor of the pelvis. We have seen instances of repair in both these fractures, but they are very rare indeed, and in the former case severe lameness continued throughout life.

The external angle of the ilium is frequently broken and displaced more or less in a downward direction without materially affecting the patient's usefulness. In these cases a replacement of the broken fragments cannot be effected owing to the downward pull of the muscles attached to it, but it continues to be connected to the part from which it was torn by a strong band of connective tissue, and the patient suffers only a temporary inconvenience from the accident. Here rest is all that is needed to bring about a satisfactory result.

Less frequently, but in a large proportion of cases, the same good result follows under the same simple course of treatment when the internal angle is broken.

Some prospect of recovery offers, where the fracture involves only the neck of the ilium, so long as there is no displacement, and the same remark applies where the point of the ischium is broken; but it frequently occurs that the parts break away in the course of repair, before it has sufficiently advanced to keep them in position.

Except in those forms of fracture last referred to, unless some special value be attached to the injured animal for stud purposes, the desirability of prompt destruction should be well considered. Experience teaches that in the most favourable cases, where reunion of the broken pieces is complete, some deformity of the pelvis, some irreparable interference with nerves or vessels, or wasting of muscles, is left behind to cripple the patient after long and costly nursing.

Perfect quietude as far as it can be enforced is the one condition to be aimed at, and this will be best secured by placing the animal in slings. In doing so it should be observed that the ground is not slippery, and that it is well covered with peat-moss or saw-dust, or, failing these, a thick covering of sand. Peat-moss being the softest, most adhesive, and least likely to jar the limb, is to be preferred. It may be that the patient may experience some difficulty for a time in emptying the bladder, owing to being unable to extend himself. In such cases the urine must be withdrawn by means of the catheter with as little disturbance to the horse

as possible. Brisk friction or rubbing with a brush over the legs and quarter will tend to relieve stiffness and afford comfort while under restraint.

A diet composed of bran and roots, with a moderate amount of hay, chaff, and a few crushed oats, is the most suitable, and two table-spoonfuls of linseed-oil incorporated with it three or four times a week will serve to keep the bowels regular. Everything should be done to minister to the comfort of the animal, and time must do the rest.

FRACTURE OF THE BONES OF THE HIND EXTREMITY

Fracture of the Femur.—Notwithstanding the large muscles which everywhere surround and protect the femur, it is sometimes made to yield to the violence which in one form or another is applied to it. The causes which determine fracture of this bone are mostly kicks from other horses, violent struggling while undergoing operations or in endeavouring to escape from some difficult and confined position. It sometimes results from a slip while attempting to start a heavy load.

The seat and nature of the fracture varies in different cases. Sometimes the head is broken off through the neck, at others the diaphysis or shaft is divided in a transverse or oblique direction (fig. 328), or one or both condyles may be separated from the inferior extremity of the body, or the large trochanter broken away from the upper extremity of the bone. The signs of fracture here are not usually difficult to read. Sudden and acute lameness, with inability to bear weight, and difficulty in advancing the limb, are at once manifest. When the animal is made to move, the leg is advanced with an outward swing and displays unnatural mobility. Crepitation is made apparent by passive movement of the broken pieces, first in one direction and then in another. As the animal stands, the quarter sinks into a resting position.

Reposition or reduction of the fracture is always difficult, mostly impossible; and when accomplished the size, form, and relations of the thigh oppose the application of appliances to retain the broken fragments in apposition. It will be seen, therefore, that unless great value is set upon an animal for breeding purposes treatment is not likely to prove remunerative, and should not be encouraged.

An unserviceable cripple is with very rare exceptions the only return for much expense and trouble.

Slinging, pitch plasters over the part, and such quietude as can be procured are the only available if doubtful means of effecting a reunion of the parts.

Fracture of the Tibia.—Fracture of this bone is comparatively frequent. Its greater length, more exposed position, and less ample protection by muscles than the femur render it more liable to succumb to external violence.

The internal surface of the bone is quite superficial, having no other covering than the skin. This is its most vulnerable point, and when sharp forcible blows are applied to it, it not unfrequently splits or breaks.

Kicks, blows, false steps, collisions with cart-shafts, carriage-poles, and stone walls, and violent struggling when cast either by accident or designedly for the purpose of an operation are the causes by which it is chiefly produced.

Symptoms.—The outward manifestations resulting from the mishap will depend upon the more or less completeness of the fracture. Sometimes the bone is only partially broken through, and, the parts being maintained in their natural position, comparatively little pain or inconvenience is suffered; so little, indeed, that in some cases the nature of the injury remains undetected for days and weeks, until by the strain of work the fracture is rendered complete by the parts being torn asunder, or the fragments becoming displaced in the act of lying down or rising from the recumbent posture. In such circumstances the evidence of fracture becomes clear and decisive; the horse fails to support weight on the injured limb, which, when raised from the ground, hangs limp and pendulous, and crepitus is readily detected in it.

Partial fracture may provoke more or less lameness, the seat of which may or may not be indicated by swelling. But in the absence of swelling, pressure applied over the surface of the bone will afford material evidence of the existence of fracture.

Treatment.—Where the fracture is complete the prospect of restoring the horse to a state of usefulness is very remote, indeed so much so that it is only where high value is set upon the patient for breeding purposes that the result would be likely to prove at all satisfactory. In this case the limb should be enclosed in a strong pitch plaster, laid on in a succession of layers from below the hock as high as the stifle.

Further support may be given to the broken fragments by strips of thick cardboard let into the plaster over the region of the fracture. With this should be conjoined the support of slings and perfect rest.

Fracture of the Bones of the Hock.—This is an accident of exceptionally rare occurrence, and mostly concerns the calcaneum (*os calcis*) or bone forming the point of the hock. Occupying a prominent position, and standing exposed to external violence, it is remarkable that it so seldom suffers fracture.

Kicks, blows, and violent struggling when cast are the most common causes. In foals the point of the hock is sometimes torn off when rearing and walking backwards on the hind-legs.

The symptoms resulting from this mishap are very striking and characteristic.

There is a complete inability to support weight on the broken limb. When an attempt is made to do so the hock joint sinks towards the ground, and the point of the hock is drawn upwards by the pull of the tendo achillis, the foot is advanced, and the quarter on the injured side inclined downward. In progression the limb as a whole is raised as far as possible, and then trailed forwards with the advancing body.

Treatment in these cases offers but little prospect of success. The tendo achillis, acting upon the broken fragment, displaces it upward beyond readjustment, and where it is practicable to bring the broken parts together it is usually found impossible to maintain them in their natural position.

Fractures below the hock may be such as have been described as taking place below the knee, and will require to be healed on the same lines.

16. ARTICULATIONS OR JOINTS

The bones of the skeleton are joined together in various ways to form joints. The manner in which they are united will depend upon the purpose they are intended to perform, hence joints are divided into three classes according to their respective range of movement. 1. *Diarthrodial* joints, which enjoy the greatest freedom of action. 2. *Amphiarthrodial* joints, whose powers of movement are much more restricted. 3. *Synarthrodial*, or those which are fixed and immovable.

Diarthrodial or Free-moving Joints are composed of two or more bones whose articular surfaces are covered with a thin layer of cartilage or gristle, and so formed as to permit one to play freely upon the other. They are all enclosed in a sac lined by a delicate membrane for the secretion of synovia or joint-oil, and for the most part the bones are held together by connecting ligaments.

Ball-and-Socket Joints.—Some diarthrodial joints are formed by the rounded head of one bone fitting into a cup-like cavity or socket contained in another bone. This is the case in the hip-joint (fig. 358), which allows the leg to be moved in all directions—inward, outward, forward, backward—and also to be rotated and circumducted or moved in a circle.

Hinge Joints.—Others assume the form of hinge joints, in which

convexities or prominences on one bone fit into depressions or grooves in its fellow. In this form of articulation the movement of the joint, like that of a door, is only to and fro or in the direction of flexion and extension. A good example of this class of articulation will be found in the tibio-tarsal or true hock joint (fig. 361), the elbow-joint, &c.

Arthrodia or Gliding Joints.—This variety of diarthrodial joint is found in the knee (fig. 354) and the hock joints where the small flat bones are closely united together, one upon the other, so as to allow simply a limited gliding motion in various directions.

Amphiarthrosis or Mixed Joints.—In this variety the bones are connected by a disc of fibro-cartilage, and possess just as much movement as the flexibility and compressibility of the joining substance allows. Mixed joints have no smooth surfaces or synovial capsules. Examples of this description of joint are found in the union of the bodies of the vertebræ (fig. 346), where a pad of elastic fibro-cartilage exists and gives to the spine as a whole its flexibility and springiness without permitting undue mobility between each pair of vertebræ.

Pivot Joints.—Here a pointed extremity of one bone furnishes a pivot on which another bone turns. This is the case with the odontoid process of the dentata or second vertebra (fig. 350), which, as has been previously explained, passes into the ring of the atlas or first neck-bone, and permits a rotary movement of the latter upon the former.

Synarthrosis or Immovable Joints.—This form of articulation prevails where flat bones are united together by their borders to form cavities, as in the case of the cranium and the cavities of the face. In some of these a joining is effected by the overlapping of thin plates of bone. In others, small tooth-like processes from one bone project into the other, while a third is united by the dovetailing of small serrations, &c.

ARTICULATIONS OF THE TRUNK

Intervertebral Articulations.—All the vertebræ beyond the second and as far backward as the first sacral are united together by their bodies and processes. The bodies are connected one to another by circular discs of fibro-cartilage which intervene between them, and by the superior and inferior vertebral ligaments, the former running along the floor of the vertebral canal, to which it is attached in small festoons. The latter is situated along the under part of the bodies from the sixth dorsal vertebra to the sacrum.

Union of the Processes.—The superior processes are connected by the *supra-spinous* ligament and the *inter-spinous* ligament (fig. 346).

The former runs along the tops of the superior spinous processes, to each of which it becomes attached from the second cervical vertebra to the sacrum.

The anterior portion is represented by a broad yellow elastic structure, termed the *ligamentum nuchæ* (fig. 347), which extends from the head backwards as far as the sixth dorsal spine, where it becomes continuous with the second portion or dorso-lumbar, which is continued to the sacrum or haunch. The ligamentum nuchæ consists of a superior rounded (funicular) portion and an inferior broad flat (lamellar) portion.

The former or funicular portion extends from the sixth dorsal spine to the posterior part of the cranium, where it becomes inserted into the tuberosity of the occipital bone. This division of the ligament is very strong, and shows a groove running along its superior surface. It is usually covered with a dense mass of fat and connective tissue, which gives roundness to the superior border of the neck.

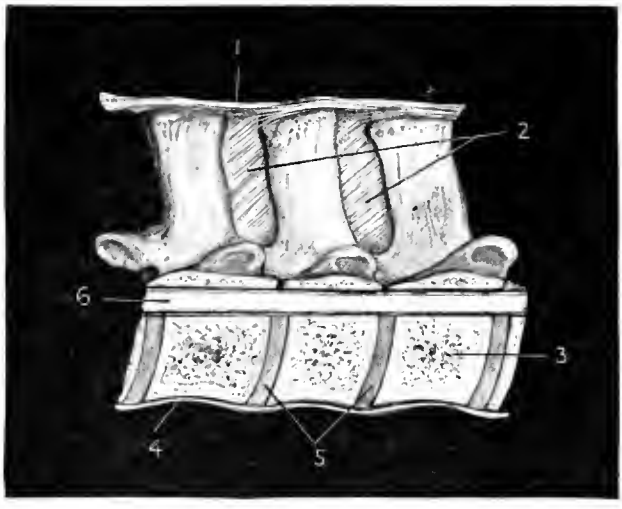


Fig. 346.—Ligaments of Spine (Side View)

1. Supra-spinous ligament. 2. Inter-spinous ligaments. 3. Bodies of dorsal vertebræ divided longitudinally and vertically. 4. Inferior common ligament. 5. Inter-vertebral discs. 6. Spinal canal.

The lamellar portion is a broad sheet of yellow elastic tissue attached to the under surface of that last described. It is composed of two layers, one placed closely in apposition with and connected to the other by a loose fibrous substance. The fibres of these layers pass obliquely forward from the spines of the first five or six dorsal vertebræ to those of the six posterior neck-bones. The supra-spinous ligament gives support to the head and neck, and thereby relieves the muscles from the weight which would otherwise be imposed upon them at all times. Moreover, by its elasticity it allows of a certain degree of stretching, and freedom of movement in all directions. Situated in the middle line of the neck it separates the muscles of one side from those of the other.

The *dorso-lumbar* portion of the supra-spinous ligament is attached to the summits of all the lumbar and the twelve or thirteen posterior dorsal spines. In front it becomes continuous with the cervical division or "ligamentum nuchæ", behind with the sacro-iliac ligament.

Interspinous Ligaments (2, fig. 346).—In the dorso-lumbar region there is a series of short flat layers of connective tissue passing in a backward and downward direction from the posterior border of the superior spinous process of one vertebra to the anterior border of the one succeeding it. In the cervical region they are composed of elastic tissue to allow of a more extensive and free movement of the neck.

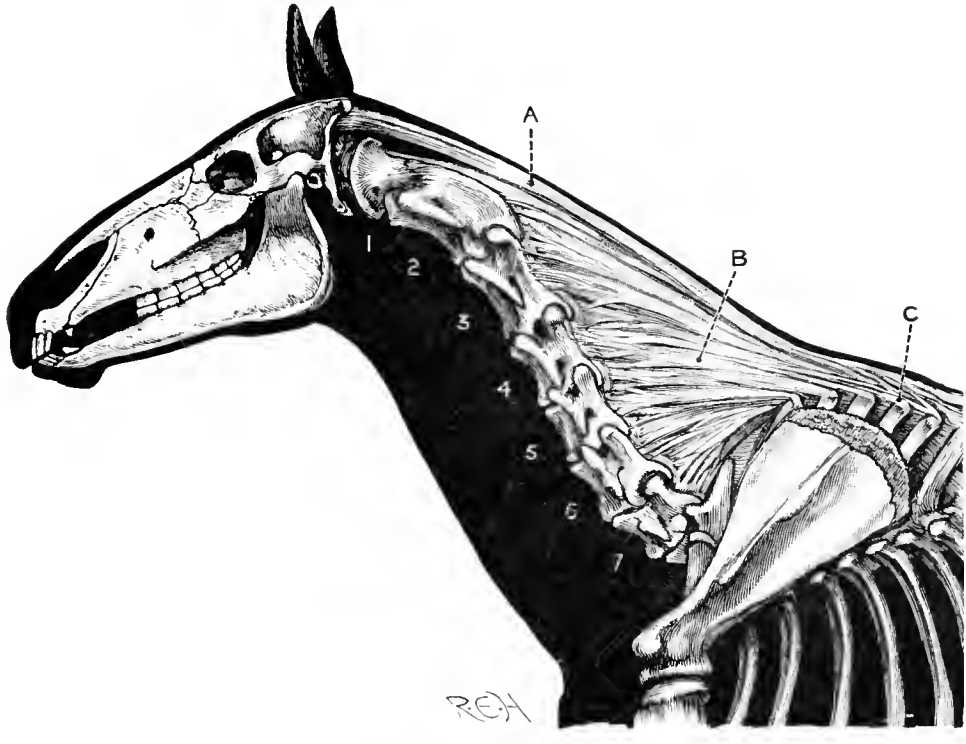


Fig. 347.—Ligamentum Nuchæ

A, Funicular or cordiform portion. B, Lamellar or flat portion. C, Attachments to dorsal spines. Nos. 1 to 7, Cervical Vertebræ.

The *articular* processes of the vertebræ throughout are connected by means of a capsular ligament, and the same may be said of the articulations on the *transverse* processes of the two last lumbar and first sacral vertebræ.

ARTICULATIONS OF THE HEAD

It has elsewhere been pointed out that these are for the most part immovable, and the mode of formation has been described.

The **Tempero-Maxillary Articulation** (fig. 348) or joint formed between the lower jaw and the temporal bone is an exception.

Here the condyles on the superior part of the inferior maxilla fit into

shallow cavities provided by the squamous temporal bones. The condyles and the cavities are not brought immediately into contact with each other, but are separated by flat pieces of fibro-cartilage moulded on to the opposed surfaces, and having a synovial membrane between them and each of the bones forming the joints.

The bones and cartilages are enclosed in a capsular ligament which, as

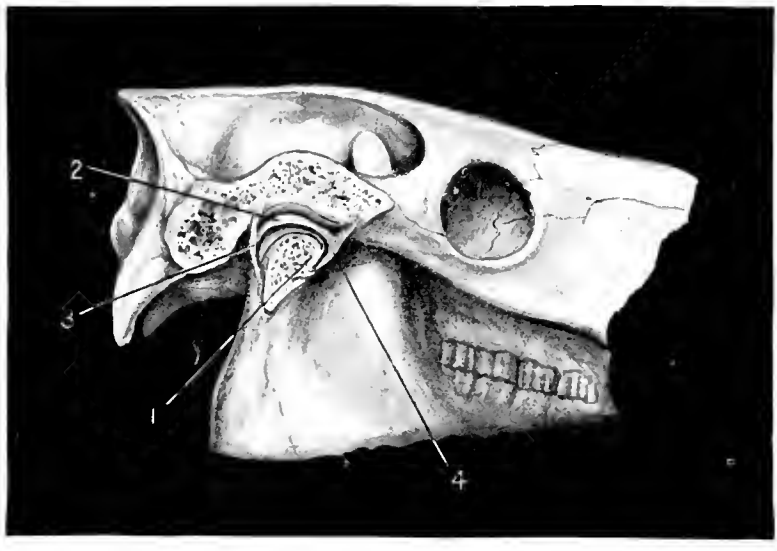


Fig. 348.—Temporo-Maxillary Articulation

1. Section through maxillary condyle.
2. Inter-articular fibro-cartilage.
3. Posterior portion of capsular ligament.
4. Anterior portion of capsular ligament.

we have already observed, is lined by a synovial membrane and strengthened by a bundle of fibres on its outer surface.

HYOIDAL ARTICULATIONS—JOINTS OF THE TONGUE

These are three in number, two cartilaginous and one synovial. The cartilaginous or amphiarthrodial joints are formed by the union of the superior extremity of the long horn of the hyoid bone with the petrous temporal bone, and the inferior extremity of the same with the superior extremity of the short horn. The synovial articulation exists between the lower end of the short horn and the body of the bone. See fig. 291, p. 189.

ARTICULATIONS OF THE RIBS

All the ribs are connected with the vertebræ above, and the first eight true ribs are also united with the sternum below, by synovial articulations

or joints, by which means they are enabled to move freely in the required directions during respiration or breathing.

Costo-Vertebral Articulations.—Each of these joints is formed by the articulation of the head of a rib between the bodies of two vertebræ, and by the union of the tubercle of the rib with the transverse process of the vertebra behind it. Several small ligaments enter into each joint

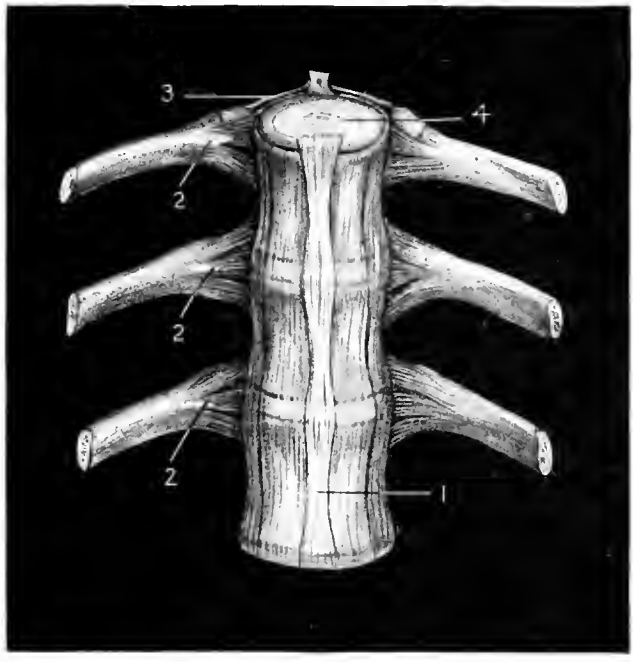


Fig. 349.—Articulation of the Ribs and Spine

1. Common inferior vertebral ligament. 2, 2, 2. Inferior costo-vertebral ligaments. 3. Inter-articular costo-vertebral ligament. 4. Inter-vertebral fibro-cartilage in section.

and unite the rib firmly to the spine, while at the same time permitting free play of one bone upon the others.

Costo-Sternal Articulations.—These are the joints formed by the union of the inferior extremities of the cartilages of the eight true ribs with the sternum or breast-bone. Each articulation has a capsular ligament lined by a synovial membrane, and two other connecting ligaments extending from the costal cartilage above and below to the sternum—superior and inferior *costo-sternal ligaments.*

ARTICULATIONS OF THE HEAD WITH THE NECK

Occipito-Atloid.—The union of the head with the neck is effected by the articulation of the two occipital condyles with corresponding concavities

on the anterior face of the atlas. This joint is enclosed in a capsular ligament (one to each condyle) and is further supported by small muscles passing over it above and below (fig. 350).

Atlo-Axoid.—The atlo-axoid joint is formed by the projection of the

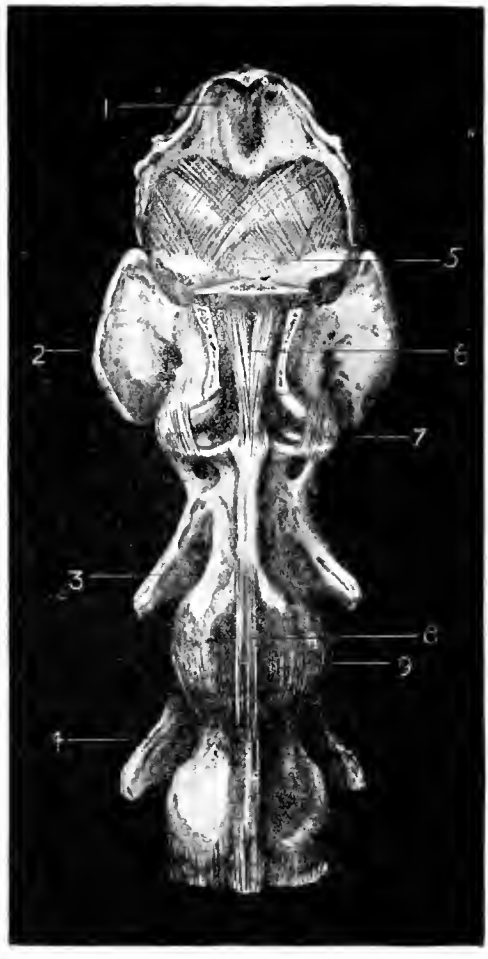


Fig. 350.—Occipito-Atloid Articulation

1, Occipital Bone. 2, Atlas (the upper wall removed to show the odontoid ligament). 3, Axis or Dentata. 4, Third cervical vertebra. 5, Capsular ligament. 6, Odontoid ligament. 7, Fibrous capsule (partly removed). 8, Interspinous ligament. 9, Fibrous capsule, uniting the articular processes of the vertebræ.

odontoid process of the axis into the ring of the atlas, where it is retained by the odontoid ligament (fig. 351). Other ligaments, the superior and inferior atlo-axoid and the capsular, also enter into the structure of the articulation.

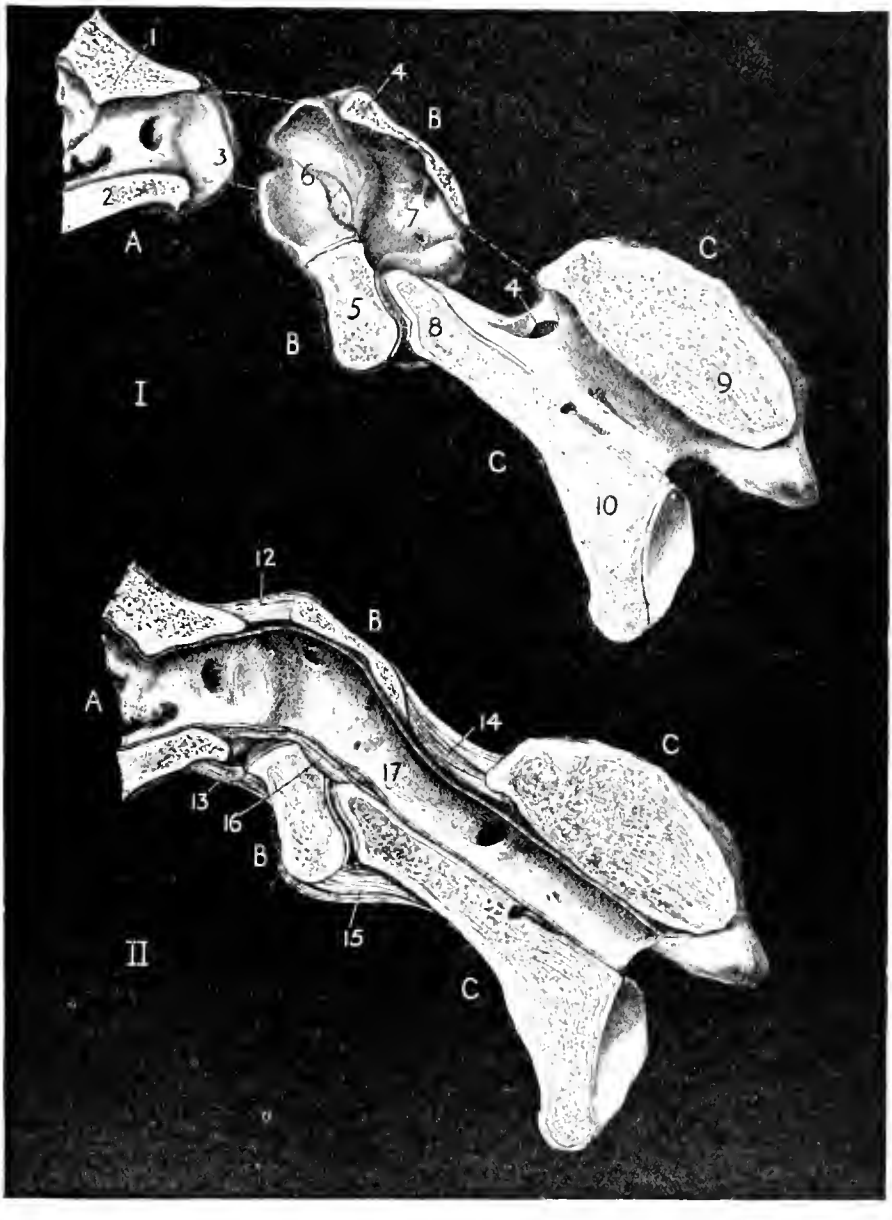


Fig. 351.—The Occipito-Atloid and Atlo-Axoid Articulations

A A, Posterior portion of skull. B B, Atlas. C C, Axis or Dentata.

I.—Vertical section through the occiput, atlas, and axis. (The occiput is drawn apart from the atlas in order to show the articular cavity of the latter bone.) 1, The occipital bone. 2, Its basilar process. 3, Occipital condyle. 4, Superior arch of the atlas. 5, Its inferior tubercle. 6, Articular cavity (shown viewed in front at 3, Fig. 2, Plate XXXVIII). 7, Spinal canal. 8, Odontoid process of the axis. 9, Its superior spinous process. 10, Its inferior spinous process. 11, Spinal canal.

II. Vertical section through the same bones in their natural position, showing the ligaments. 12, Superior occipito-atloid ligament. 13, Inferior occipito-atloid ligament. 14, Superior atlo-axoid ligament. 15, Inferior atlo-axoid ligament. 16, Odontoid ligament. 17, Spinal canal, with the dura mater in position. (The spinal cord has been removed.)

SCAPULO-HUMERAL OR SHOULDER-JOINT

The shoulder-joint results from the union of the glenoid or shallow cavity on the inferior extremity of the scapula or blade-bone, with the much larger articular surface provided by the head of the humerus or upper arm.

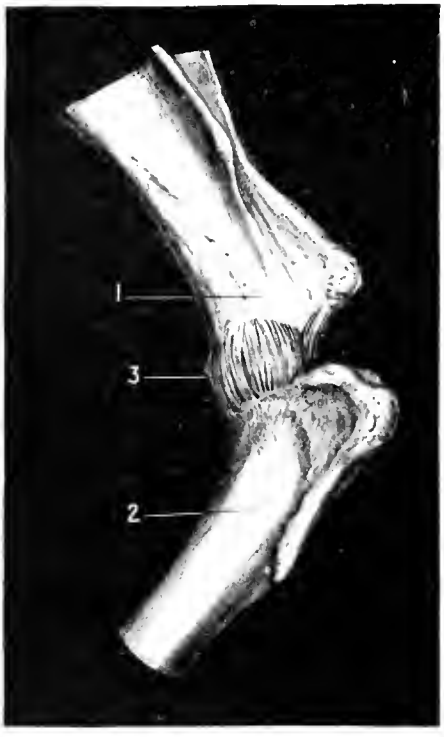


Fig. 352.—Capsular Ligament of Shoulder-Joint

1, Scapula. 2, Humerus. 3, Capsular Ligament.

This joint, although so large, possesses only one ligament, the capsular (fig. 352), but it receives the support of a number of muscles which pass over it and are intimately connected with it.

The shoulder-joint is capable of describing a great variety and considerable range of movement. It allows of flexion, extension, abduction, adduction, rotation, and circumduction.

HUMERO-RADIAL OR ELBOW-JOINT

Three bones are engaged in the formation of this joint—the humerus above, the radius below, and the ulna behind. It has two lateral ligaments passing from the humerus to the radius. The outer one is the stronger and shorter of the two; the inner, the longer and smaller. It has also a capsular ligament of considerable extent, lined by synovial membrane. It is essentially hinge-like in its action, and admits only of movements of flexion and extension (fig. 353).

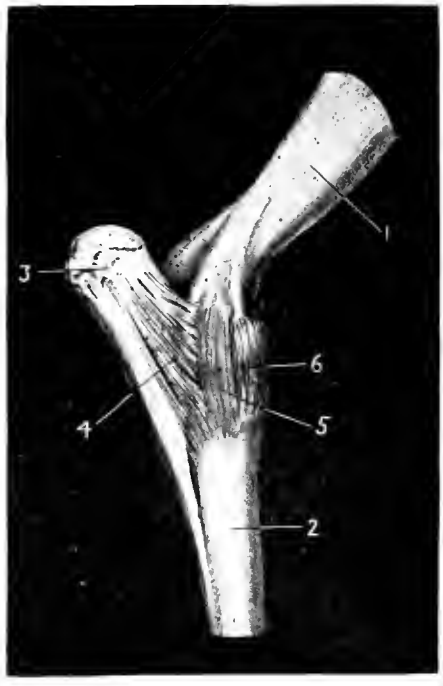


Fig. 353. Humero-radial or Elbow-Joint

1, Humerus. 2, Radius. 3, Olecranon process of ulna. 4, Arciform ligament. 5, External lateral ligament. 6, Anterior ligament.

ARTICULATIONS OF THE CARPUS OR KNEE-JOINT

As we have elsewhere pointed out, the knee is not one joint but several; the chief of which are: 1, the *radio-carpal*; 2, the *carpal*; 3, the *carpo-metacarpal*. In addition, other small articulations exist on the sides of the bones forming the two rows (fig. 354).

The **Radio-carpal** articulation is formed by the inferior extremity of the radius or lower arm and the superior surface of the upper row of carpal bones, the two parts being suitably modelled to each other. This joint enjoys and imparts to the knee the greatest range of movement.

The **Carpal** joint is that between the two rows of small bones, and its action, although considerable, is less extensive than that of the radio-carpal.

Fig. 354.—The Carpus or Knee-Joint

1, Radius. 2, Large metacarpal or canon bone. 3, Small metacarpal or splint bone. 4, Pisiform bone. 5, Common external ligament. 6, Radio-carpal ligament. 7, Carpo-metacarpal ligament. 8, Anterior ligaments uniting the two rows of carpal bones. 9, Anterior ligaments proper to the carpo-metacarpal articulation.

Fig. 355.—Anterior View of Knee-Joint

1, Radius. 2, Scaphoid. 3, Lunare. 4, Cuneiform. 5, Os magnum. 6, Uneiform. 7, Canon. 8, Transverse connecting ligaments. 9, Oblique connecting ligaments.

The **Carpo-metacarpal** articulation is formed by the inferior surface of the lower row of bones and the superior extremities of the three metacarpal bones. In the movement of the knee this joint contributes nothing to flexion and extension, but allows a gliding movement favourable to the action of the joints above.

The articulations by which the bones composing each row are united together laterally are small, and only

allow of such a measure of gliding movement as will enable the larger articulations to perform their more extensive and important functions.

The Ligaments.—The ligaments uniting the bones of the knee are numerous, and comprise *lateral ligaments*, or those passing from the sides of the lower end of the radius—first to the upper row of bones, then to the lower, and finally to the upper extremity of the metacarpal bones (figs. 354 and 355); *inter-osseous ligaments*, or those situated between the small bones which they unite; and a *capsular ligament*.

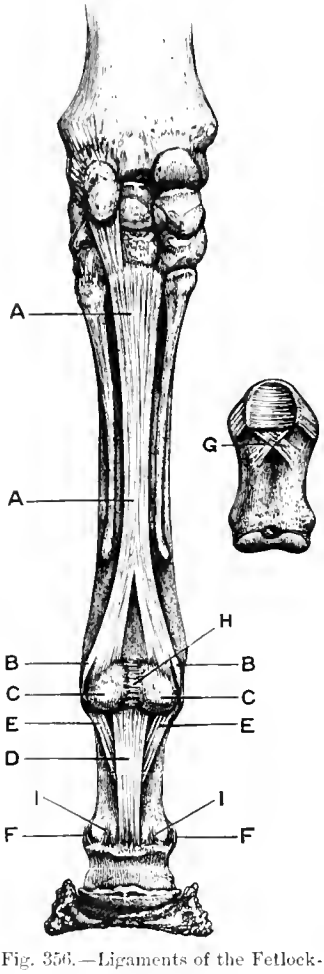


Fig. 356.—Ligaments of the Fetlock-Joint

A, A, Suspensory ligament. B, B, Outer and inner branches of same. C, C, Outer and inner sesamoid bones. D, Superficial or long sesamoid ligament. E, E, Deep or short sesamoid ligament. F, F, Lateral phalangial ligament. G, Crucial sesamoid ligament. H, Intersesamoid ligament. I, I, Posterior inter-phalangial ligaments.

The capsular ligament of the knee is, like the joint, of considerable extent. Proceeding from above, where it is attached around the articular margin of the radius, it descends, to be similarly connected with the superior extremity of the large metacarpal bone. Behind, it is very thick, and is attached to all the small bones of the knee, and below it is continuous with the check ligament which joins the tendon of the flexor pedis perforans.

THE METACARPO-PHALANGIAL ARTICULATION OR FETLOCK-JOINT

The bones which enter into the construction of the fetlock-joint are four in number, the large metacarpal or canon-bone, the os suffraginis or long pastern, and, behind these, two small sesamoid bones.

The lower extremity of the canon-bone rests upon the superior extremity of the large pastern, the convexities of the one fitting into corresponding concavities presented by the other. The two sesamoid bones are closely united together by a thick, short, strong ligament (*intersesamoid ligament*), and articulate with the back part of the lower extremity of the canon-bone. The importance of this joint as a spring and a means of breaking and dispersing jar or concussion has rendered necessary a number of ligaments over and above those ordinarily present in a diarthrodial or free-moving joint.

In addition to a capsular ligament, common to all the bones, there are also two lateral ligaments uniting the canon with the large pastern, and two lateral sesamoid ligaments, each having two branches extending from the bones of that name forward, one to the lower and outer part of the large metacarpal bone, and the other to the upper and outer part of the long pastern bone (fig. 357).

As the sesamoid bones have no support from below, it is necessary they should have it from above, to prevent their undue descent. This is provided by the suspensory ligament (fig. 356), the lower extremity of which, after dividing into two thick strands, is inserted into these bones. A similar provision is made to prevent too great upward displacement. For this purpose three ligaments (*inferior sesamoid*), distinguished respectively as the long, short, and crucial, connect the sesamoid bones with the posterior border of the os coronæ, and with the posterior surface of the long pastern.

The movements of this joint are hinge-like and of great range both in flexion and extension.

FIRST INTERPHALANGIAL ARTICULATION OR CORONET-JOINT

This is a simple joint, of limited action, and formed by the union of the lower extremity of the os suffraginis with the upper extremity of the small pastern. The ligaments which unite these bones together are a capsular ligament, two strong short lateral ligaments, some of the fibres of which descend and ultimately become connected with the extremities of the navicular bone, and two short posterior ligaments (fig. 357).

Its movements are those of flexion and extension.

SECOND INTERPHALANGIAL ARTICULATION OR COFFIN-JOINT

The bones concerned in the construction of this joint are the os coronæ or coronet-bone, the os pedis or foot-bone, and the os naviculare or navicular bone. The two last-named bones are united together in such a manner as to form two concavities separated by a slight central ridge, to which are applied the two convexities and central groove upon the lower end of the coronet-bone.

The ligaments of this joint are: 1. The capsular, common to the three bones. 2. The lateral ligaments uniting the os coronæ to the foot-bone. 3. The navicular ligaments: *a*, the broad or interosseous ligament extending

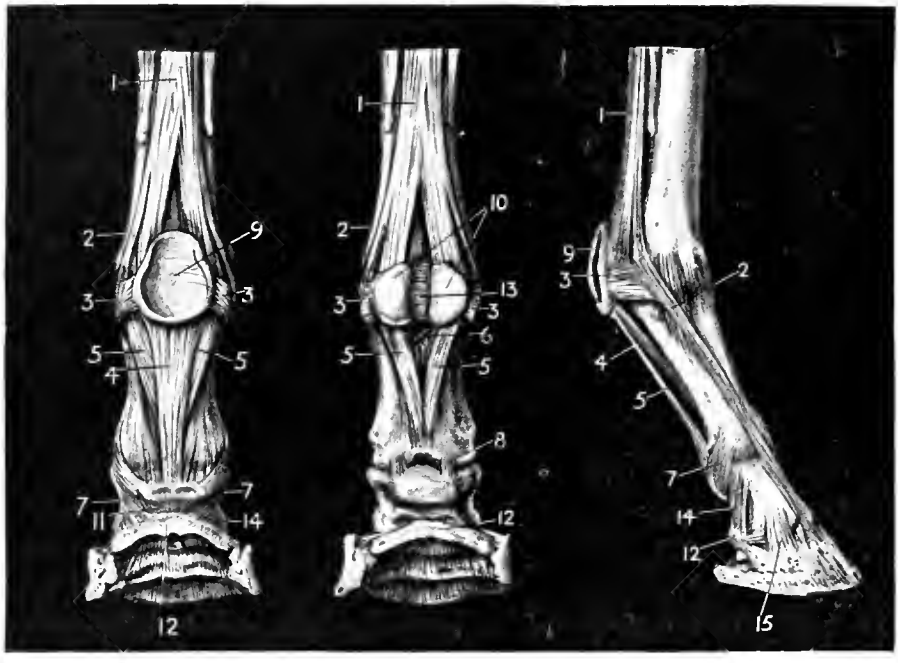


Fig. 357.—Ligaments of the Pastern and Foot

A, Posterior aspect, outer layer. B, Inner layer. C, Side view.

1, Superior sesamoid or suspensory ligament, giving off a band, 2, to the extensor pedis. 3, Lateral sesamoid ligament. 4, Superficial inferior sesamoid ligament. 5, Deep sesamoid ligament. 6, Crucial ligament. 7, Lateral ligament of the coronet-joint. 8, Posterior interphalangial ligament. 9, Intersesamoidal substance over which the tendons pass. 10, Sesamoid bones. 11, Ligamentous substance common to the coronal and navicular bones. 12, Navicular bone. 13, Intersesamoid ligament. 14, Lateral navicular ligament. 15, Anterior lateral ligament of the coffin-joint.

from the anterior border of the navicular bone to the under surface of the os pedis or foot-bone; *b*, the lateral navicular ligaments which proceed from each extremity of the navicular bone (1) to the wing of the foot-bone, (2) to the inner surface of the lateral cartilage, and (3) to the side of the coronet-bone.

The movements of the coffin-joint are flexion and extension.

COXO-FEMORAL ARTICULATION OR HIP-JOINT

The hip-joint is formed by the union of the head of the femur or thigh-bone with the cotyloid cavity of the coxa (fig. 358).

Four ligaments are engaged in connecting the two bones, viz. the capsular, cotyloid, round, and pubio-femoral.

The **Capsular Ligament** is attached around the articular margin of the femur, to the margin of the cotyloid cavity, and to the cotyloid ligament. Its inner surface is lined by a synovial membrane.

The **Cotyloid Ligament** is a ring of fibro-cartilage attached around the margin of the cotyloid cavity. It serves to increase the depth of the cup, and at the same time to give it a yielding margin for the protection of the head of the femur. This ligament bridges over the notch in the inner part of the cup through which the pubio-femoral reaches the head of the thigh-bone.

The **Round Ligament** (*ligamentum teres*) is a short, strong fibrous cord extending from the bottom of the acetabulum to the inner side of the head of the femur.

The **Pubio-femoral Ligament,** although short, is longer and thicker than the round ligament. It is derived from the tendons of the abdominal muscles, which, in front of the pubes, cross from right to left and left to right, and then proceed to the head of the femur to be attached beside the round ligament.

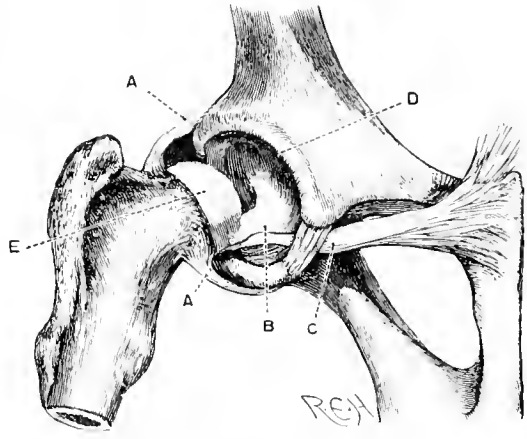


Fig. 358.—Articulation of the Hip-Joint

A, A, Capsular or enclosing ligament. B, Round ligament. C, Pubio-femoral ligament. D, Cotyloid ligament. E, Head of femur.

The hip-joint is capable of the most varied and extensive movements. Not only is it freely flexed and extended, but as constructed it also permits of abduction, adduction, circumduction, and rotation of the femur on the acetabulum.

FEMORO-TIBIAL ARTICULATION OR STIFLE-JOINT

This is the corresponding joint to the knee of man. It is formed by the union of the femur with the tibia on the one part, and with the patella or knee-cap on the other. The femur articulates with the upper extremity of the tibia by its two condyles, and with the patella by its two ridges or trochlea in front. Between the two condyles and the head of the tibia there are two crescentic pieces of fibro-cartilage (*semilunar cartilages*) which serve to mould the rounded condyles of the thigh-bone upon the flatter articular face of the tibia.

The three bones composing this joint are united by numerous strong ligaments, so disposed as to permit the greatest freedom of motion, while at the same time offering adequate resistance to the great strain which is thrown upon them.

The ligaments are divisible into three sets, viz. those which connect

the patella to the femur and tibia; those which unite the two last-named bones together; and those which attach the semilunar cartilages to them.

Patellar Ligaments.—These are five in number—two *lateral* and three *straight*. The lateral ligaments extend from the inner and outer sides of the patella to corresponding parts of the lower extremity of the femur.

The *straight* ligaments, distinguished as the *external*, *internal*, and *middle*, are attached above to the anterior surface of the patella, and below to the anterior tuberosity of the tibia.

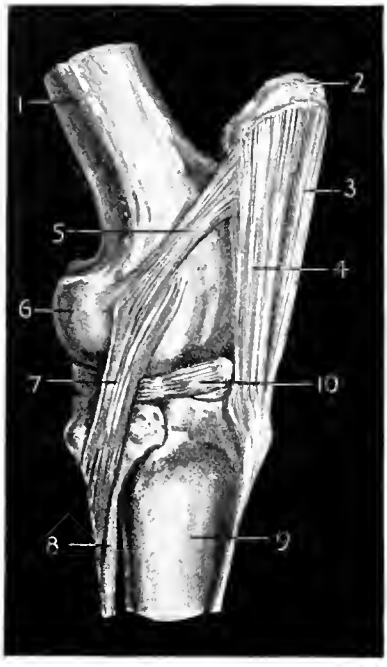


Fig. 359.—Femoro-tibial Articulation or Stifle-Joint

1, Femur. 2, Patella. 3, Middle straight ligament. 4, External straight ligament. 5, External lateral ligament of patella. 6, Outer condyle. 7, External lateral femoro-tibial ligament. 8, Fibula. 9, Tibia. 10, External inter-articular cartilage.

The middle ligament plays over a synovial bursa in the groove below which it is attached, and is, besides, clothed in a thick cushion of fat.

The **Femoro-tibial Ligaments** are five in number, viz. two *lateral*, two *crucial*, and a *posterior*. The lateral ligaments are situated one on either side, and extend from the inner and outer condyle of the femur respectively, to the superior extremity of the tibia on the inner side, and to the fibula on the outer side.

The **Crucial Ligaments.**—These are two thick short bands situated in the notch which separates the two condyles, where they cross each other like the lines of the letter X. The anterior branch is attached to the spine on the upper end of the tibia, and to the intercondyloid notch and the external condyle. The posterior branch is united by its lower extremity to the superior and posterior part of the tibia, and by its upper end to the notch between the condyles and to the internal condyle.

The **Posterior Ligament** is practically the posterior section of the capsular ligament of the femoro-tibial articulation. It is attached to the femur, behind and above the condyles, and to the posterior part of the head of the tibia, just below its articular margin. It joins the lateral ligaments, uniting the femur and tibia on either side, and its inner face is lined by synovial membrane.

The **Interarticular Fibro-cartilages** are the crescentic pieces of dense fibro-cartilage upon which the condyles of the femur are made to

rest on the head of the tibia or second thigh. They are hollowed out above for the reception of the condyles, for which they form a bed. The outer cartilage is attached in front to the base of the spine on the head of the tibia, and behind by two slips, one to the notch between the condyles, and the other to the upper and posterior part of the tibia.

The inner cartilage is attached in front and behind to the base of the spine on the head of the tibia.

This joint possesses three synovial membranes, one of considerable extent enclosing the articular surfaces of the patella, and the two ridges or trochlea in front of the femur, and one to each condyle of the femur and its corresponding half of the articular face of the tibia.

The movements of this joint are essentially those of flexion and extension, but it also enjoys a limited power of rotation.

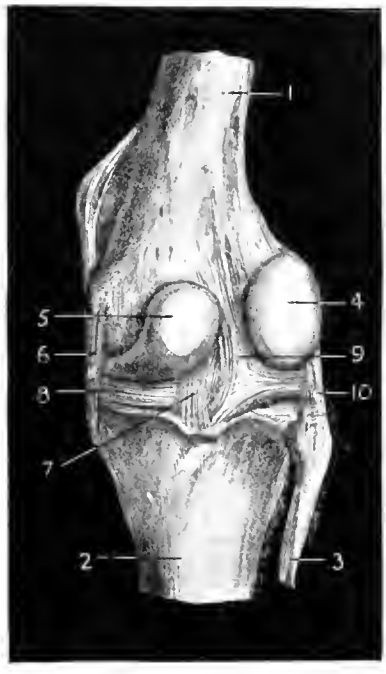


Fig. 360.—Posterior View of Stifle-Joint

1, Femur. 2, Tibia. 3, Fibula. 4, External condyle. 5, Internal condyle. 6, Internal lateral ligament. 7, Posterior crucial ligament. 8, Internal inter-articular cartilage. 9, Posterior ligament of cartilage. 10, External lateral ligament.

TIBIO-FIBULAR ARTICULATION

This joint, of very small dimensions and of most limited action, is formed by the union of the inner surface of the head of the fibula with the upper and outer part of the tibia. The two bones are connected by short, strong fibres, which completely surround the joint.

THE ARTICULATIONS OF THE TARSUS OR HOCK-JOINT

The so-called hock-joint, like the knee, is formed of a number of articulations, by which the various bones are enabled to move one upon the other. The extent of movement between the different pieces varies from a slight gliding action to a great range of flexion and extension.

In the tibio-tarsal articulation, or the "true hock-joint", seven ligaments are engaged, viz., two external lateral, three internal lateral, and an anterior and posterior.

Both external lateral ligaments are attached above to the tuberosity (*outer malleolus*) on the lower and outer part of the tibia. The *superficial* one, the longer and stronger of the two, passes down the outer side of

the hock, and in its course becomes united with the astragalus, calcaneus, cuboides, and finally with the large and outer small metatarsal bones.

The **External Deep Ligament,** on leaving the outer tuberosity of the tibia, inclines backward, and becomes attached to the astragalus and the calcaneus.

The **Internal Lateral Ligaments** are placed one within the other, and are distinguished as the *superficial*, the *middle*, and the *deep*. All of them are attached above to the tuberosity (*internal malcolus*) on the inner part of the lower extremity of the tibia. From thence the *internal superficial ligament* passes downward and becomes connected with (1) the astragalus, (2) the scaphoid, (3) the cuneiform, and (4) the large and internal small metatarsal bones.

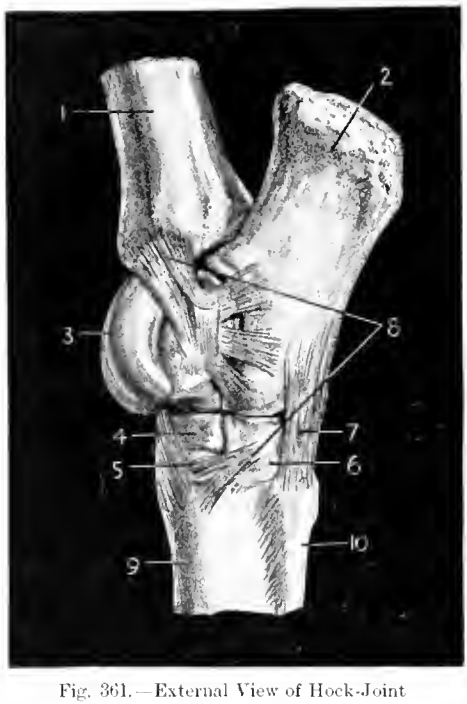


Fig. 361.—External View of Hock-Joint

1, Tibia. 2, Calcis. 3, Astragalus. 4, Os magnum. 5, Os medium. 6, Cuboid. 7, Calcaneo-cuboid ligament. 8, Deep set of ligaments connecting one bone with another. 9, Large metatarsal bone. 10, Small metatarsal bone.

The **Internal Middle Ligament,** situated beneath that last described, divides into two short strands, one of which is implanted into the astragalus, and the other into the calcaneus.

The **Internal Deep Ligament** is a small batch of fibres which becomes attached to the astragalus.

The **Anterior Ligament.**—This presents the form of a broad membranous or capsular ligament stretching over the front of the true hock-joint. It is lined by synovial membrane, and is that portion of the capsule which bulges in what is termed "bog-spavin". The anterior ligament is united to the lower part of the tibia above, it is attached below to the astragalus and the small bones of the hock in front, and at the sides it blends with the lateral ligaments.

The **Posterior Ligament** is situated behind the joint, and is much thicker than the anterior, having in its centre a quantity of fibro-cartilage, over which glides the perforans tendon in its course to the foot. On either side its fibres mix with those of the superficial lateral ligament, and in front, where it faces the joint, it is lined by synovial membrane. Above it is attached to the tibia, and below to the astragalus and calcaneus.

The joints below the hock are the same as those below the knee, which have already been described in considering the articulations of the fore-limb.

DISEASES OF THE JOINTS

As we have elsewhere pointed out, joints vary very considerably, not only in their structure, but also in the purpose they serve. Some, as those by which the bones of the head are united, are fixed and immovable, while those of the extremities enjoy a considerable range of action, and upon their liberty or freedom of movement depends the power of locomotion. The former are formed solely by two bones held together by the interlocking of their serrated edges, while the latter comprise not only two or more bones whose articular surfaces are encrusted with cartilage, but these are enclosed in a synovial membrane spread over the internal surface of a sac termed the capsular ligament. In addition, strong bands of fibrous tissue, in the form of "connecting ligaments", unite the bones together. This form of joint is known as the *diarthrotic*, and is the most free-moving of the several varieties.

A third variety of joint is found uniting the bodies of the vertebræ. Here, between the bones, a dense cushion of fibrous tissue is interposed. It has no synovial or capsular membrane, as in the case of the diarthrotic variety of joint, and its range of movement is very restricted, being only so much as to impart to the spine a limited degree of flexibility and strength. This is known as an *amphiarthrotic* joint.

Of the three varieties of joints above referred to, it is very seldom that disease is found to exist in any but those of the diarthrotic class, and in this section the joints of the extremities afford by far the greater number of examples. Their larger size, more exposed position, great range of action, and liability to jar, concussion, and sprain, are no doubt the factors which tell in favour of disease.

Joint diseases are brought into existence either by local or constitutional conditions, or both, as when the latter predispose to the influence of the former.

If there is one period of life when horses suffer more from joint disease than another, it is from birth up to six years old, when the burdens they have to bear are badly apportioned to their condition and strength, and when certain constitutional ailments which determine these affections are most prevalent.

External violence is perhaps the most common *exciting* cause of joint disease. Kicks from other horses, slips, falls, blows, sprains, and penetrating wounds by which inflammation more or less severe is excited in one or

another of the component structures, are the chief inducing factors. Fractures, by extending into the joints, not only provoke in them acute and dangerous disease, but so far damage and impair their action as seriously to compromise further usefulness. Wounds in connection with joints are of especial difficulty and danger, not only on account of the joint having been opened, but because of the entrance into it of septic organisms which excite a suppurating or matter-forming process, first in one structure and then in another, until all have become implicated.

Of those constitutional conditions to which joint disease can be referred, rheumatism offers a striking and by no means an uncommon example.

Within sixty yards of where the writer now sits is a gray cob which, while passing through an attack of influenza fever, suddenly became acutely lame in both fore-limbs, so much so that her movements could only be compared to those of an animal in the last stages of chronic navicular disease. Every joint and sinew in the limbs was perfectly normal, but the heat in the feet and the fulness in the heel clearly indicated some mischief in the navicular joint, which was diagnosed as rheumatism. A blister was applied over the coronets and the mare was turned to pasture, when she became perfectly sound in three weeks. Rheumatism affecting the joints and other structures presents itself also as a sequel of strangles and purpura.

In that pyæmic condition of foals known as "navel ill", the large joints of the extremities frequently become distended with pus and serous exudation as the result of pyæmic arthritis, and mares, after parturition, now and again suffer from a similar affection, parturient synovitis.

Inflammation of the lining membrane of the heart (endocarditis) is sometimes associated with an abiding inflammation of the joints.

All these possible causes require to be borne in mind when considering the origin of joint disease. In numerous instances swelling of a joint, resulting from "pyæmic arthritis" or "joint ill" in foals, has at first been referred to a kick from the dam or other form of external violence, and the error has only been recognized when other joints becoming affected rendered the view no longer tenable. This leads us to point out that where disease of the same nature attacks one joint after another in the same animal, some constitutional cause should be suspected, whereas disease confined to one joint only will usually be found to result from accident.

The Local Origin of Joint Disease varies in different cases. It may first commence in the synovial membrane, or in the bone or the cartilage. It does not, however, always confine itself to the structure in which it originates, but frequently extends from one to another until all are more or less involved. Sometimes the connecting ligaments will also become affected and suffer with the rest in the morbid action.

Disease most commonly commences in the synovial membrane, and next in the bones, but seldom in the articular cartilage and connecting ligaments.

This greater susceptibility to become primarily affected is no doubt due to the greater vascularity of the two tissues referred to, and their higher functional activity.

Symptoms.—The general symptoms of joint disease are such as result from an attack of inflammation in one or all of the structures entering into the formation of the articulation.

Lameness is more or less severe, according to the structure involved and the stage of progress of the disease. Swelling of the part, with more or less heat and pain under pressure, will also be observed.

ANCHYLOSIS

Anchylosis is that condition of a joint in which the bones forming it are united in such a way as to restrict or altogether prevent their natural movement taking place. The various means by which this is effected has given rise to a division of anchylosis into *true* and *false*. True anchylosis results when, as a consequence of disease, the two ends of the bones within the capsular membrane become united. False anchylosis is induced when inflammatory products surround and enclose the joint, and become callous or ossified, or in other ways fix the ends of the bones and prevent their movement.

Anchylosis may be *complete* or *incomplete*. In the former the union is effected by ossific new growth between or around the ends of the bones forming the joint, and the movement is altogether arrested. In the latter the bones are bound together by fibrous or fibro-cartilaginous tissue, which allows a limited degree of movement to take place in the joint. The uniting medium in this case may sooner or later become converted into bone, by which complete anchylosis is effected. The incomplete form of the disease therefore represents a stage in the development of the complete; in other words, when the fibrous tissue existing in the one becomes ossified, it is converted into the other.

Causes.—Anchylosis is the result of inflammation affecting the joint or parts about it. External violence, in the form of blows, wounds, sprains, and other injuries, is the exciting cause.

In the matter of treatment, but little can be done to render an animal of service for anything but slow work, unless for breeding purposes.

To break down the morbid development uniting the bones by physical force is a practice sometimes adopted in man, but the ultimate success of

such an operation depends upon the complete control and obedience of the patient, which cannot be obtained in the horse.

SYNOVITIS—INFLAMMATION OF THE SYNOVIAL MEMBRANE

When the lining membrane of a free-moving joint becomes inflamed, the disease is known as synovitis.

The attack may be *acute* or severe, *subacute*, or *chronic*, in which last case it continues for a more or less protracted period. The first and second forms may become resolved into the third.

Causes.—Synovitis is for the most part induced by blows, sprains, and penetrating wounds; or it may follow upon exposure to cold and wet; or arise in the course of an attack of pyæmia, or after the ingestion of food or water contaminated with lead or copper smoke.

ACUTE SYNOVITIS

This form of the disease most frequently results from wounds which injure or puncture the capsule of the joint, and especially such as are contaminated with septic matter at the time of or after infliction.

The size of the wound is no measure of the danger which may attend it. A dirty stable-fork entering a joint may prove as destructive as a wound inches in length. Pyæmia is a common cause of acute synovitis in foals, and less frequently in young horses when suffering from strangles.

Severe blows and sprains, and acute attacks of rheumatism, especially when following upon influenza, are also fruitful causes of it.

Symptoms.—Lameness more or less severe is the first noticeable symptom of the disease. The joint becomes distended with synovia, and bulges at points where there is least resistance. The swelling thus formed is tense and fluctuating, and when pressed acute pain is evinced. Soon the outer structures of the joint become enlarged, hot, and tender. The animal stands with the leg in a semi-flexed condition, imposing little or no weight on it. The local suffering soon gives rise to constitutional disturbance, attended with considerable fever and prostration.

As the disease progresses the joint becomes filled with pus, the inflammation spreads to structures round and about it, one or more abscesses form and break, and the purulent contents of the joint escape.

In those cases where joint abscess develops, the articular cartilage undergoes softening and displacement, and the underlying bone becomes exposed and diseased. In such circumstances the function of the joint is

seriously impaired or altogether destroyed, and should the patient recover, his or her services can only be reckoned on for breeding purposes.

Treatment.—The first concern should be directed towards providing conditions for affording rest and relief from pain. To this end the floor should be covered with peat-moss, tan, or saw-dust, and the patient should be placed in slings.

A dose of physic at the outset will prove beneficial, and the diet should be light and sparing. Scalded bran with a little chaff, and some roots or green meat will be most suitable for the purpose.

The limb should be supported and its movements restricted by the application of bandages.

The joint should then be irrigated with cold water four or five times a day, and in the intervals the bandages should be repeatedly soaked with it.

If a wound exists it should be thoroughly cleansed, freely irrigated with five-per-cent solution of carbolic acid, and kept aseptic by suitable dressing.

Where the pain is acute and the suffering great, the affected joint should be anointed twice a day with belladonna and glycerine, in the proportion of one part of the former to two of the latter, and if necessary an opiate may be given from time to time to alleviate pain and ensure rest.

When the acute symptoms have subsided, the part may be vigorously rubbed with weak soap liniment, and gently-increasing pressure applied to the swollen joint by means of a bandage.

This may require to be followed up by one or more blisters, and a course of iodide of potassium administered to effect removal of the swelling.

CHRONIC SYNOVITIS

Chronic synovitis may follow upon an acute attack of the disease, or arise directly from an injury inflicted upon a joint.

As in acute synovitis, the joint capsule is more or less distended with fluid, and bulges at certain points where most exposed. The pain, however, is not so severe as in the acute form of the disease. In this connection considerable variation is observed from time to time. One day the patient gives promise of improvement, but this is mostly followed by a set-back sooner or later, and the general tendency of the malady is in the direction of an unfavourable issue.

The joint, after becoming filled with serous fluid, may ultimately contain pus (matter), which sooner or later escapes through abscesses on the surface. The appetite becomes indifferent, the constitutional disturbance is severe,

and the patient succumbs to the exhausting effects of protracted suffering associated with blood-poisoning.

On the whole these cases offer but little hope of successful treatment.

The system should be sustained by good food, with stimulants when required, and the local treatment should be pursued on the lines laid down for acute synovitis.

LOOSE CARTILAGES IN JOINTS

It sometimes occurs that small bodies, varying in size from a pea to a walnut, are found loose in the cavities of joints, especially the larger ones, such as the stifle, hock, or knee.

These formations are generally ovoid in shape and somewhat flattened. In colour they are yellowish-gray or grayish-white, and vary in composition not only in different cases but in the same joint.

Some are composed of cartilage or fibro-cartilage, interspersed or not with bony matter, while a few are almost entirely made up of the last-named substance.

Some of these formations originate as outgrowths from the internal surface of the synovial membrane, from which they hang suspended for a time, and are then broken away by the movements of the joint and become free or, as they are termed, "loose cartilages".

Others more distinctly cartilaginous in type commence as small excrescences along the margin of the articular cartilage, and these, like those last referred to, are rubbed off, and when disconnected move about the joint, interfering with action and causing pain and lameness, which may be continuous or intermittent.

As to whether these excrescences grow after their detachment from their place of origin it would be difficult to say, but there is reason to think that such is sometimes the case.

Symptoms.—While connected with the synovial membrane or the cartilage these growths may occasion very little disturbance, and even when detached, small ones, while in a soft, fibrous, or cartilaginous condition, do not seriously interfere with action; but the larger and harder ones provoke serious attacks of lameness by becoming fixed between the ends of the bones and the capsular membrane and otherwise damaging the joint.

In a case which occurred in a three-year-old colt under the care of the late Mr. Joseph Axe of Doncaster, and which the writer had an opportunity of seeing and examining after death, the patient was slightly lame of the near hind-leg for several weeks before the seat of lameness could be localized. Suddenly the animal became incapable of advancing the limb,

and exhibited considerable pain when caused to move. The stifle-joint then began to swell owing to distension of the capsule with fluid; there was also considerable heat and tenderness to pressure. The swelling continued, but the lameness almost entirely disappeared in a week, only, however, to return with increased severity a fortnight later. This subsidence and return of the acute symptoms was repeated on three or four occasions, each time leaving the joint larger and the lameness more severe. Ultimately the colt was destroyed, and three loose cartilages (fig. 362), one being an inch and a half long and three-quarters of an inch wide, were removed from the joint capsule.

The two smaller ones consisted of fibro-cartilage, and the largest of cartilage interspersed with bony matter. The joint contained a large

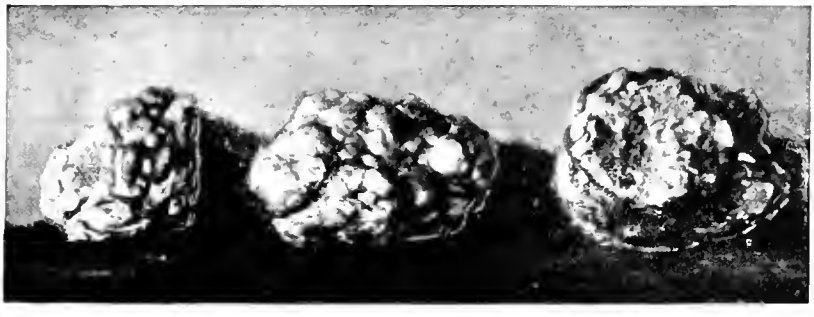


Fig. 362.—Loose Cartilages removed from the Capsule of a Stifle-joint

quantity of dark, straw-coloured fluid, and the synovial membrane was considerably inflamed and thickened.

Treatment.—Nothing short of the removal of the offending bodies by a surgical operation can be of service in these cases, but the difficulty interposed to an accurate diagnosis by the thickness of the skin, the ligaments, and parts about the joint, renders such a course as unreliable as it is dangerous.

The remedy, indeed, may prove even worse than the disease.

RHEUMATIC ARTHRITIS

In this disease we recognize a local expression of a constitutional disorder arising out of some as yet undefined noxious principle in the blood.

Aged animals are more especially its victims, but it sometimes also affects the young.

In the former it assumes a chronic type, while in the latter the attack is more frequently of the acute variety.

Causes.—These are predisposing and exciting. Most if not all subjects of this affection inherit a constitutional condition which predisposes them to suffer when exposed to one or another of the various exciting causes. Of these the principal are exposure to wet, and cold easterly and north-easterly winds, hard and continuous work, sprains, concussions, blows and other injuries to the joints, influenza, and strangles.

Symptoms.—The disease may be confined to a single joint, but more often it invades two or more. The large joints, as the knee, the hock, the stifle, and the fetlock, are those most frequently involved. In its chronic form rheumatic arthritis commences with stiffness, observed more particularly after exertion. For some time it may continue without materially interfering with the animal's movements. Then a slowly progressive enlargement appears—at first resulting from distension of the capsular membrane with synovia, but later the bones of the joint throw up irregular nodular swellings around and about their articular ends, and these, encroaching on and irritating the surrounding ligaments and tissues, provoke additional enlargement. Pain and lameness are now more or less marked, and the action of the affected joint becomes not only restricted but difficult.

In long-abiding cases the cartilage may be removed from the articular ends of the bones, whose rough surfaces, when brought into contact with each other, impart to the hand and the ear a crepitating sensation or sound. In this disease there is no tendency to the formation of abscess, but the morbid action is expended in provoking enlargement and condensation of the extremities of the bones and tissues connected with the joint.

Treatment.—In this connection much importance attaches to an early recognition of the disease, when a dose of physic, followed by a short course of iodide of potassium, and a brief rest, will usually check its progress. Where it has been allowed to advance so far as to produce considerable swelling, massage and friction should be freely applied to the joint two or three times a day, and in the intervals it should be enclosed in a warm flannel bandage. The food should include a liberal amount of carrots or other succulent roots or grasses, with bran and a small ration of scalded corn and sweet hay

With this may be given an ounce of linseed-oil night and morning, with a full dose of iodide of potassium and carbonate of potash. If the joints are very painful they may be anointed with belladonna liniment twice a day. Should this not have the desired effect, a mild iodine blister repeated at short intervals may yield good results.

Horses giving evidence of this affection should have a dry lair and be protected as far as possible from cold and wet, especially while heated.

PYÆMIC ARTHRITIS

This is one of the most destructive of joint ailments. Foals a few days old are its most common victims, although now and again older horses suffer from it also. It ranks with the infective diseases, and results from the entrance of septic organisms into the blood-stream through a wound or broken surface. It is very destructive of joints, and the patient rarely recovers.

Causes.—It occurs in foals a few days after birth, when the newly broken navel-string affords an opportunity for the entrance of septic organisms into the blood-stream through the vessels of the cord.

Males are more frequently attacked than females. The most susceptible period is from five days to three weeks old.

The onset of the disease is marked by slight dulness and depression, with a disposition to lie about. This is quickly followed by swelling on one or more of the joints, chiefly the stifle, knee, hock, or elbow.

From the rapidity with which the swelling develops and the intensity of the lameness, owners and attendants frequently refer the disorder to injury inflicted by the dam,—an impression which is sometimes difficult to remove until joint after joint becomes involved in the disease. The enlargement of the joint commences by distension of the capsule, and soon extends to the surrounding tissues. It is hot, firm, and painful to the touch; small, soft, fluctuating points appear here and there, which break and discharge a quantity of yellowish-gray pus (matter). The lameness is very severe and mostly forbids the imposition of weight upon the limb, which is carried or lightly brought into contact with the ground during progression.

In addition to these local symptoms there are noticeable a high temperature, increased respiration, great prostration, an indisposition to suck, and other signs of a fever attack.

Death usually takes place from the fourth to the eighth day after the onset of the disease. In some cases it kills in thirty-six hours, and in others it is prolonged over three or four or more weeks.

Treatment of pyæmic arthritis is discouraging to the last degree and the percentage of recoveries so small as to be regarded as a negligible quantity.

It is rare indeed that recovery takes place, for in addition to extensive disorganization of joints the blood is saturated with the poison of pyæmia, and the young thing has but little strength to resist it.

In the few cases where life is preserved the damaging effects of the

disease on the affected joints leave the animal a cripple for life and an undesirable possession.

Having regard to the serious losses which this affection annually occasions in our large and fashionable studs, and the resistance it offers to treatment, it behoves breeders of horses to give every consideration to those more reliable measures by which the disease may be prevented.

It has been already pointed out that a wound to be infected, and organisms to infect it, are the essential factors in the origin of the disease, and to protect the one against the other is all that is needed to ensure its prevention.

To do this requires a considerable amount of care and attention, first as regards the sanitary condition of the box and its surroundings, and secondly as to the navel wound by which the poison enters the body of the foal.

The foaling-box should be large, well-ventilated, efficiently drained, and situated away from the crew-yard and other filthy sites. It should have a washable floor, and an interior the whole of which can be readily disinfected and washed or lime-whited. At the commencement of every season it should receive a thorough cleansing and disinfection from floor to ceiling, and this should be repeated from time to time as foaling proceeds. The box should be well littered with clean straw, which must be removed and replaced by a fresh supply as each mare passes out. At the same time the floor should be freely dressed with disinfecting solution and covered with lime.

So soon as the foal is born the navel-string should at once receive a thorough soaking with a five-per-cent solution of carbolic acid, and half an hour after be dusted over with boracic acid powder. If it is necessary to ligate or tie anything round it, catgut, macerated for some time in carbolized oil, should be used. In all well-appointed studs a bottle containing a link of this material is kept ready for use.

It is of the first importance that whoever has the handling of the umbilical cord should not only have clean hands but should have previously dressed them with an efficient disinfectant.

The navel, the cord attached to it, and skin about it, should be freely disinfected three or four times a day with fluid dressing, and afterwards covered with a powder of boracic acid and iodoform.

Until healing of the umbilical wound has been completed foals should not be allowed to scamper over manure heaps, or dirty roads, or any unclean surface.

SPRAINS TO JOINTS, TENDONS, AND LIGAMENTS

The severe efforts which horses are called upon to make, and often under the most trying circumstances, render them specially liable to overtax the muscles, tendons, ligaments, and joints of the extremities, or in other words unduly stretch or strain them. Sprain is one of the most common ailments affecting the legs of horses. It may consist in a mere overstretching of the fibres of a structure, or some may at the same time be ruptured.

Its origin cannot be considered altogether apart from conformation, for it is found that any considerable departure of the legs from the perpendicular tending to disturb the centre of gravity has the effect of unequally distributing the weight of the body, and predisposing certain parts on which it falls in excess to sprain. Knees in-bowed or out-bowed, knees set unduly backwards, feet turned outward or inward, cow hocks, and various other defects of conformation are conditions favourable to this accident.

Big joints, besides providing a large surface of support to diffuse and minimize concussion, are also furnished with large strong ligaments by which they are able to resist sprain, while small joints, whose connecting structures are wanting in substance and strength, more readily yield to the force applied to them.

These unfavourable conditions are aggravated when left out of consideration in the operation of shoeing. When one part of the crust is unduly lowered beyond another the already unequal distribution of the weight on the structures which bear it may be materially increased.

Narrow, leggy horses, which lack stability owing to their narrow base of support, are rendered liable to sprain by their tendency to slip.

The exciting causes of sprains consist in violent extension of the structures involved; but Williams observes "extension is not always the cause of a strain, as a muscle may be injured by the opposite condition, namely, violent contraction, its fibres and their theca broken across their long axes, or its tendinous fibres torn from their attachments at either or both of its extremities".

Slips and false steps, severe efforts at draught, or in the gallop or jumping, or in struggling to remove a limb from a fixed position, are causes of the violent extension from which sprains result.

Symptoms.—These will vary with the structure affected. Generally they comprise lameness, tenderness of the part with or without swelling, resting of the limb in such a way as to relieve tension and take the weight

off the injured organ. These will be dealt with in the articles on sprains to special structures.

BOG-SPAVIN

This disease is of an entirely different nature from that referred to in the section on "Diseases of the Organs of Locomotion". It is presented by a soft fluctuating enlargement at the upper and inner part of the hock-joint, arising out of distension of the capsule (fig. 363) of the true hock-joint with synovia or "joint oil".

Causes.—It most commonly occurs in young horses between one and three years old. The heavy breeds are especially liable to it, and most so animals of lymphatic temperament, with round fleshy legs, coarse hair, thick skin, and feeble energy.

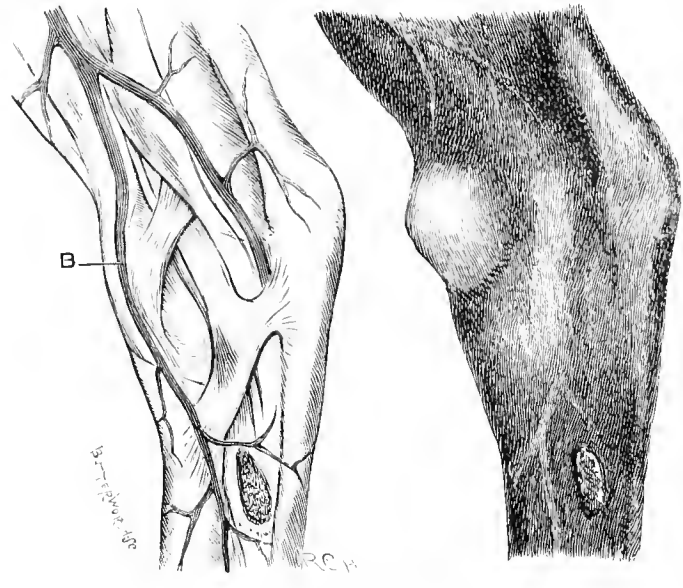


Fig. 363.—Bog-Spavin

B, The distended joint with the skin removed

The predisposition to bog-spavin is essentially hereditary. It may also be acquired by causes which induce poverty and weakness. Young colts of rapid growth when badly nurtured readily contract the disease. The exciting causes are overwork while young, and sprains to the joint; but large numbers of cases are induced by the pernicious system of forcing, which young stock undergo during their show-yard career, and we have known many fine specimens of the heavy breeds to have been hopelessly ruined in their infancy by this practice.

Symptoms.—Bog-spavin may arise suddenly, or it may appear in a slow and progressive manner. The former is mostly the case when the result of sprain, and also as a consequence of high feeding and confinement. Work and wear lead to a more gradual and often a more abiding enlargement of the joint. Where the disease is sudden in its onset, it is usually attended with pain and lameness, and the joint is hot, tense, and painful to pressure.

The amount of swelling varies in different cases, sometimes it is very considerable, in which case it is not confined to the front of the joint, but is also seen on either side near to the seat of thorough-pin, for which it is often mistaken. It must be pointed out that the lameness is not always in proportion to the size of the swelling. Very large bog-spavins are sometimes found to occasion but slight defect in action, while smaller ones may be attended with severe lameness.

Treatment.—In this disorder the object of treatment will be—1, to subdue inflammation; 2, to promote absorption of the fluid existing in the capsule of the joint; 3, to prevent excess of secretion; and 4, to bring about contraction of the overstretched and enlarged joint capsule. Where the disease is attended with inflammatory symptoms, or is brought about by dietetic causes, a dose of physic should be promptly administered and the animal put on a bran diet. Hot fomentations to the part, or what is equally beneficial, douching the joint with cold water for half an hour to an hour three times a day, will be necessary. Should the latter course be adopted, cold-water bandages must be applied to the part in the intervals and frequently changed.

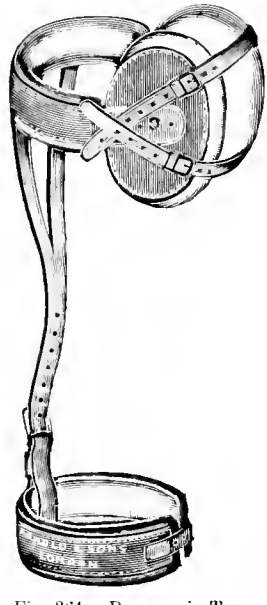


Fig. 364.—Bog-spavin Truss or Compress

After the inflammatory action has been subdued a blister should be applied over the entire surface of the hock, and repeated if necessary two or three times at intervals of three to four weeks.

In the more chronic cases, firing, and blistering over the fired surface, will require to be resorted to. Iodide of potassium, given in doses of 2 to 3 drams morning and evening, will assist in the reduction of the swelling. Where poverty exists a liberal ration of good food should be allowed, together with iron tonics.

Animals suffering from bog-spavin are benefited by a run at grass after the inflammation has been reduced, and in some cases the absorption of the fluid may be hastened by the application of a suitable compress to the affected joint (fig. 364).

SPRAIN OR STRAIN

A sprain is an injury to a ligament, a tendon, a muscle, or a joint, in which there is over-extension and sometimes laceration of fibres and maybe displacement of parts.

Ligaments and tendons, with one or two notable exceptions, are inelastic, and tear rather than stretch when a force is applied beyond their power of resistance. The apparent elongation in a "break down" is due to the rupture of a number of fibres in more than one place, and not to actual fracture across the ligament. In the case of strain so violent as to dissolve the connection of one part with another, the separation will usually be found close to the bone and not in the middle or seemingly weakest portion. The ligament or tendon tears away from its attachment, or carries with it a thin layer of bone.

The rarity of complete rupture of a ligament in the middle portion is due to the close weaving of its fibres into a dense rounded bundle, whereas at the ends the fibres spread out to afford a wider attachment to the bones, and are consequently more loosely connected with each other. The great strain put upon certain ligaments, when a draught-horse exerts himself to start a load, is easily borne while the pull is a straight one, but if he be suddenly turned, and a twisting and unequal force is applied to the fibres, rupture is very likely to occur. The force which will extend the fibres of a tendon, or ligament, or muscle will of necessity injure the nerves and blood-vessels concerned in their innervation and nutrition; the pain suffered is due to pressure upon, or else laceration of, the former, and the swelling which follows to the escape of fluid from the latter into the structure of the part.

In the process of repair additional enlargement results from the deposition of new matter, which may be in excess of that actually required. Some of this surplus matter will in time be removed, but it frequently happens that a considerable amount remains behind as a chronic swelling after all active disease has ceased.

This undue development of reparative tissue will in some instances interfere with the action of the part and impair its function. In whatever manner he attempts it, the surgeon's chief concern is to get rid of superfluous growth and to restore the parts as nearly as possible to their normal state.

SPRAIN OF THE FLEXOR BRACHII

In the anatomical portion of this work the flexor brachii muscle is described as largely tendinous. It is wholly so in the portion which passes over the bicipital groove in front of the humerus, where it acts as a rope over a pulley before gaining insertion into the head of the radius. Being situated at the point of the shoulder it is much exposed to injury from blows, as well as to sprains, in performing its office of flexing the forearm upon the humerus.

Symptoms.—Save in exceptional cases this accident is easy of diagnosis. The muscle is comparatively superficial, and can be seen and felt to be swollen and tender to pressure, and to stand out distinctly from the surrounding structures. There is difficulty in raising the limb from the ground, and when this is attempted the toe is directed downward or the foot may drag on the ground; if the limb be flexed at the knee and then forcibly drawn backward the animal evinces pain. The bursa in front of the shoulder when sharing in the inflammation becomes more or less distended with fluid. It not unfrequently happens that injury to this muscle is associated with disease affecting the upper end of the humerus (bicipital groove) or arm-bone at their point of contact, and the shoulder-joint may also be involved at the same time. Owing to the large proportion of fibrous tissue entering into the composition of the flexor brachii it is rendered specially prone to ossification as the result of inflammation. This change into bone commences in the tendinous portion and may involve the whole of its substance by degrees. In case of other muscles of a more fleshy character, it will be remembered that atrophy and not ossification results from injury and subsequent disuse.

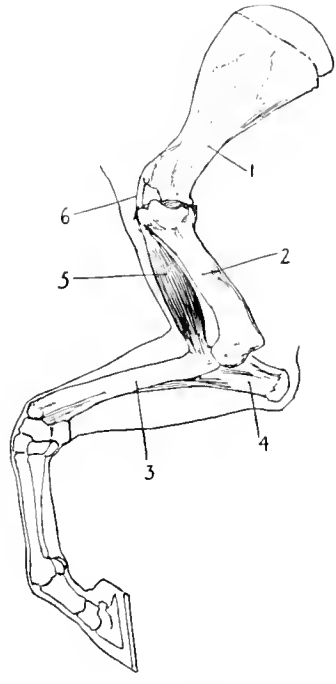


Fig. 365.—The Flexor Brachii (internal aspect)

1, Scapula. 2, Humerus. 3, Radius. 4, Ulna. 5, Flexor Brachii. 6, Tendon of origin of Flexor Brachii.

By some it is affirmed that it is almost invariably the right shoulder which is affected, and that the trouble is frequently incurred at plough. If that be so an animal once affected in this manner should not again be employed for ploughing.

Treatment.—The chief aim is to give repose to the injured muscle, and for this purpose the patient should be confined to the stable. At first hot fomentations will be needed to reduce existing inflammation. As soon as the acute lameness has passed away blistering may be resorted to, and repeated once or twice according to the circumstances of the case. After this a turn out on a level pasture will prove beneficial. A blister-charge over the injured region is a favourite method of treatment in some districts where experience of the accident has given opportunities of observation on the different means which may be employed.

SPRAIN OF THE RADIAL OR SUPRA-CARPAL LIGAMENT

This accident occurs in resisting over-extension of the superficial flexor muscle of the fore-limb when undue weight is imposed upon it (fig. 354).

Symptoms.—Besides lameness, there is heat, swelling, and tenderness just above and behind the knee-joint, with more or less inability to bear weight on the affected limb. In severe cases the leg is advanced somewhat stiffly and with as little bending of the knee as possible.

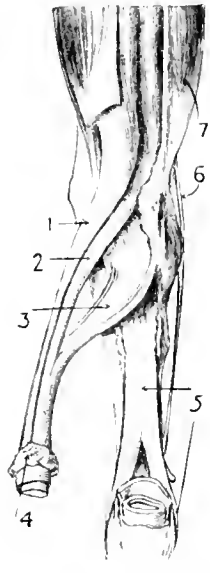


Fig. 366.—The Check Ligament

1. Flexor Pedis Perforatus.
2. Flexor Pedis Perforans
3. Check Ligament
4. Sheath
5. Suspensory Ligament.
6. Extensor Pedis
7. Flexor Metacarpi Externus.

Treatment.—In slight cases the frequent application to the part of a cooling lotion, consisting of chloride of ammonium and nitrate of potash dissolved in water, with the addition of spirits of wine and acetic acid, conjoined with rest, may suffice to bring about a cure. In sprain of a more severe character hot fomentations, followed by counter-irritation or blistering and in some cases even firing, may be called for. A dose of physic to cool the system, and a grass diet if available, are useful adjuncts to the measures prescribed.

SPRAIN OF THE CHECK LIGAMENT

This ligament (fig. 366), it will be remembered, has its origin behind the knee, and joins the perforans tendon about one-third of the distance between the knee and fetlock-joint.

Sprain of this important structure is not uncommon, especially in draught-horses when engaged in moving heavy loads out of deep holding ground or over slippery surfaces. In race-horses and hunters it usually occurs in the last efforts of a hard finish, or towards the close of a long run when the muscles are tired, and the ligaments are called upon to bear an undue amount of weight and resist the impulse of velocity.

Symptoms.—This accident is indicated by the appearance of a hot painful enlargement immediately below and behind the knee, accompanied by considerable lameness, the most prominent feature of which is that the heel of the foot is not brought to the ground in progression, and the weight of the body is quickly transferred to the opposite limb. When standing, the fetlock is maintained in a semi-flexed condition, and such weight as the foot receives is imposed upon the anterior part. With the effusion and swelling which follows severe sprain to this structure it may be difficult to determine accurately what parts are involved, and to what extent.

In slight cases, too, where the lameness is not considerable, a good deal of care is needed to discover the seat of trouble. When this is so the leg should be raised and the canon forcibly extended on the operator's knee. At the same time the operator must firmly compress the ligament between the fingers along its length, noticing while so doing any tenderness which the animal may display, or any enlargement the part may show by comparison with the opposite ligament.

Treatment.—The aperient dose recommended in connection with sprains of other structures is advisable here, and the lines of treatment in the last article should be followed, with the addition of placing a high-heeled shoe on the foot so that the injured ligament may be relieved from traction and put to rest. Care will be needed not to allow the heels to be raised too long lest in the course of reparation shortening of the tendons result.

SPRAIN OF THE SUSPENSORY LIGAMENT

The reader who has studied the anatomy of the limb, and informed himself of the origin, attachments, and divisions of this structure (figs. 356 and 366), will be prepared to learn that the ligament may be sprained in one of its branches, in both, or through its body at a point before its division takes place; or it may be ruptured or torn away from the sesamoid bones so completely that the fetlock-joint, losing its support, descends towards the ground. In slight sprains the reverse is the case; instead of the fetlock-joint coming to the ground and the toe inclining upward, the patient will endeavour to impose weight on the latter, and straighten the limb more or less in the effort.

Race-horses and hunters most frequently suffer by this accident in the fore-legs, and among draught-horses it is more often noted in the hind-limbs.

Injury to these weight-bearing structures is always a serious matter, and calls for so much time and patience that animals of little value seldom repay treatment. This is especially the case where, as sometimes occurs, it is associated with fracture of the sesamoid bones.

Every degree of lameness may be associated with injury to the suspensory ligament. In all but the very slightest cases more or less swelling appears at and about the seat of injury. There is heat in the part, and pain is provoked by pressure. To relieve the ligament from traction when standing the fetlock is maintained in a semi-flexed condition. In the severer cases the entire limb, from the knee downward, becomes more or less enlarged, and there is an entire inability to support weight.

Treatment.—Where the ligament is seriously sprained a dose of

physic should be given at once, then a high-heeled shoe should be applied to the foot and the patient put into slings. Hot fomentations should be applied to the part three or four times daily, and hot-water bandages in the intervals. This will have the effect of reducing existing inflammation, after which irrigation with cold water will give tone to the vessels and restore healthy action. A long bandage firmly applied to the leg from the knee downward will give needed support to the fetlock-joint, which will be rendered still more efficient if a thick pad of cotton-wool or tow be placed in the space between the fetlock and the heel.

Fig. 367 Sprain of the Perforans and Perforatus Tendons

As soon as possible the patient should be removed from slings and allowed to lie down. Firing or blistering, or both, should be resorted to in due course with the twofold object of inducing absorption of superfluous material from the seat of injury, and of thickening the skin so as to afford a bracing support to the part.

SPRAIN OF THE PERFORANS AND PERFORATUS TENDONS

This may occur to either one or the other separately, or to both at the same time, when the muscles to which they belong are over-fatigued, and fail to act in time and with sufficient force to prevent excessive traction on the tendons.

The hand familiar with the horse's leg will have but little difficulty in distinguishing between injury of either or both of these structures, and those strains of ligaments adjacent which have already been described. They are found to be swollen, hot, and softer than in health, and the enlargement, in bulging backwards as well as laterally, gives the tendons a convex or "bowed" appearance (fig. 367). Lameness is always present in recent cases, and during the inflammatory stages which supervene upon the accident; but there are many chronic sprains of these structures of a slowly progressive character which do not render a horse unworkable or even palpably lame to the ordinary observer. They have been described as coming "unstitched", by which term we are to suppose that in overworked horses a softening and weakening process is induced in the tendons by long-abiding strain and irritation, and a few fibres at a time rupture

here and there, and not in any particular line or order. In these cases the action is at first stilty, or, as it is sometimes expressed, "proppy", and sooner or later there is a disposition to "knuckle over" at the fetlocks in the animal's attempt to take the weight off the injured tendons and throw it forward more immediately on to the bony columns.

Treatment.—The means advised for sprains of the suspensory and check ligaments are suitable for injuries to the back tendons, as the perforans and perforatus are called.

SPRAIN OF THE FETLOCK-JOINT

By a sprained fetlock-joint is generally understood a stretching or rupture of some or all of the ligaments which unite the bones, but a not infrequent result or concomitant of such strain is inflammation of the capsular ligament and the synovial membrane which lines its interior. These injuries are perhaps in the majority of cases incurred by slipping when travelling over smooth surfaces, by treading on rolling stones or in rabbit holes, by false steps, in jumping, or in the case of draught-horses in starting heavy loads.

More or less heat, pain, and swelling in the joint, with a corresponding degree of lameness, will usually direct our attention to the structures involved. In very slight cases no perceptible change may be at once observed in the part, but a little passive movement of the joint in the direction of flexion and extension, if applied with moderate force, will have the effect of locating the injury. Where the joint itself is concerned the swelling will present here and there an elastic fluctuating character indicating the presence of an excess of fluid in the articular capsule.

Treatment.—The frequent application of evaporating lotions over the seat of injury, combined with rest and an aloetic purge, will usually suffice in mild cases. In the more severe strains, inducing acute inflammation of the structures of the joint, with its attendant pain and enlargement, hot fomentations should be promptly and freely applied until the inflammatory symptoms subside. After each fomentation flannel bandages should be placed upon the joint and repeatedly wrung out in hot water.

Absolute rest and quiet is imperative in this form of injury, and, when necessary, advantage should be taken of slinging in order to enable the patient to relieve the injured part of weight. A period of cold-water irrigation, and then blistering or firing, or both, conjoined with a long rest in a soft damp meadow, will reduce existing enlargement, and, if practicable, complete the cure.

SPRAINED BACK

When a horse's hind-feet slip under him, and especially if carrying a heavy load, he may suffer a strain of the muscles of the back, or in jumping those under the loin may be sprained. Horses, when jumping a drain and falling short, sometimes suffer sprain in their struggles to gain the bank. In some instances of this kind valuable animals have been destroyed under the erroneous impression that the back was broken, when a more careful diagnosis and judicious treatment would have restored the animal to a state of usefulness.

Paralysis is a symptom common to both broken back and sprained back, but in fracture of the spine, or serious compression of the cord, there is not only inability to rise, but inability to flex the hind-legs in any degree. In the case of sprain of the muscles of the back there remains some capacity for movement in the legs, although the patient may be unable immediately to rise.

Where there is doubt the prostrate animal should be raised by means of slings, and although he may knuckle over at the fetlocks at first, and show great distress and imperfect control of the hind-legs for a time, the absence of spinal injury will soon become apparent by returning power of the limbs to support the weight of the body.

In the case of fracture or injury to the spinal cord the hind-quarters will continue to hang helplessly in the slings, and no effort is made to stand, though the distressed creature may make fruitless attempts with his front-feet to secure a footing. In sprain of the back, in which the injury is not so severe as to preclude the animal from getting up, there will still be a difficulty in bringing the hind-legs under him, but this will gradually disappear as reparation proceeds and the muscles regain their tone.

Following upon disablement from this cause, more or less wasting or atrophy of the injured muscles will sometimes appear. The movements of the hind-limbs are for a time weak, and the fetlocks knuckle over now and again during progression.

Treatment.—Although a serious accident, sprain of the back may be regarded hopefully, the majority of cases making slow but complete recovery. Rest in slings has been mentioned already; soothing fomentations applied over the region of the back and warm enemas given frequently will prove helpful; an aperient dose of aloes at first and subsequent careful regulation of the bowels by judicious dieting is also advised.

At a later period, and prior to a run at grass, a blister over the loins is applied, and, if necessary, repeated. With a view to promoting the

renewal of muscular tone and power, strychnine and iron in small repeated doses will also be helpful.

SPRAIN AND RUPTURE OF THE FLEXOR METATARSI

The function of this muscle is to flex the canon on the hock and advance the limb. The action displayed by our best movers is for the most part due to its vigorous contractions. Arising from the lower end of the femur or thigh-bone, it terminates below in a number of strong tendinous cords, some of which are inserted into the small bones of the

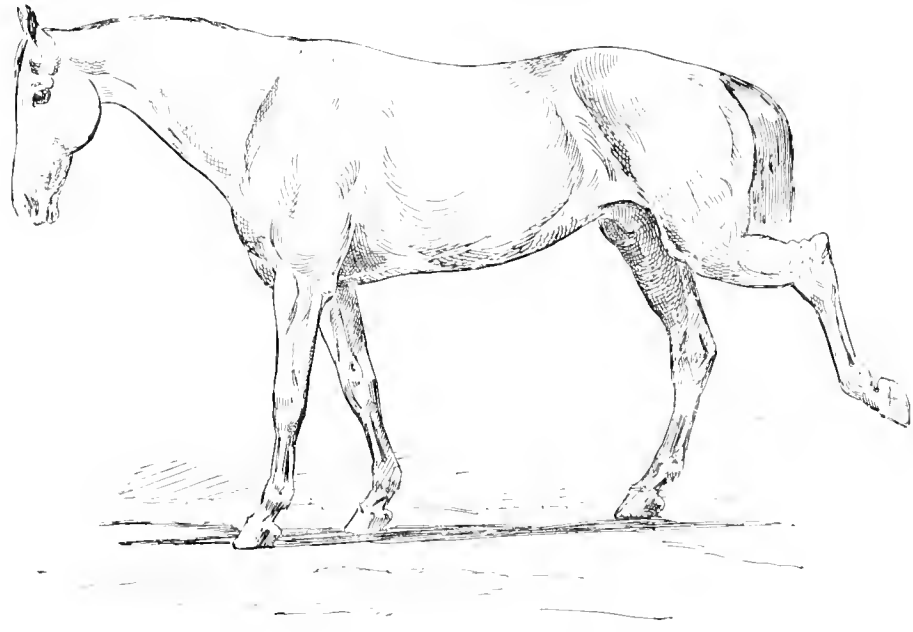


Fig. 368.—Rupture of the Flexor Metatarsi

tarsus and others in the upper and front part of the metatarsal or canon bone.

Sprain to this muscle or its tendon, although not of common occurrence, is more frequently the cause of lameness behind than is generally allowed, and the writer has observed on several occasions the development of spavin to follow upon sprain to the tendons which insert themselves into the bones of the hock. Whether in these cases the ossific development was the direct consequence of the sprain cannot be definitely stated.

The causes which stretch and strain the flexor metatarsi are chiefly those which unduly and forcibly extend the limb, such as violent kicking, slipping backward on to the front of the fetlock while carrying or drawing great weights, severe efforts in withdrawing the feet from deep ground or

rabbit holes while galloping, or when fixed in railway points, as occurs to horses engaged in shunting.

Symptoms.—In sprain to the tendons of this muscle the horse moves the leg forward with difficulty. There is inability to bend the hock, and the limb is carried forward with a slight outward swing. When standing, the heel of the foot is raised and the hind-quarter is depressed. Heat and slight swelling over the seat of injury will be observed, and deep pressure causes pain.

Where, as sometimes occurs, the muscle becomes ruptured, the leg is drawn directly backward and the sole of the foot inclined upward.

The gastrocnemii tendons (hamstrings), having now nothing to antagonize their action, become relaxed and thrown into folds.

Treatment.—Complete rest and cold-water irrigation should first be resorted to, and is usually all that is needed. Where, however, lameness continues after sprain of the tendon has been so dealt with for two or three weeks, a blister should be applied to both sides of the hock-joint, and repeated if necessary. It must on no account be applied to the front or bend of the joint, where the tendons are situated.

CURB

A curb is an enlargement on the posterior part of the hock-joint, about 4 or 5 inches below its point. Pathologically it consists in an inflammatory thickening of the sheath of the flexor pedis perforans tendon as it passes down the back of the leg. An enlargement of the calcaneo-cuboid ligament, *i.e.* a strong ligament uniting the bones of the hock behind with the splint and canon bones below, is also spoken of as curb by some, and by others certain forms of spavin are included in the term.

Causes.—Curbs are common to all varieties of the horse, but they are most frequently seen in the lighter breeds, and especially in hunters and thoroughbreds.

The causes out of which they arise must be considered under two heads, viz. predisposing and exciting. Of the former, heredity is a marked factor quite apart from conformation, for it is noticeable that the produce of some horses and mares, against the make and shape of whose limbs nothing can be said, show a special liability to the disease. It must be observed, however, that conformation is a conspicuous feature in the origin of curb. Animals with short calces, or, in other words, wanting in prominence and length of hock-point, are singularly liable to the disease, and the same may be said of others whose hind-limbs slope unduly forward, and are brought more immediately under the weight of the body.

In both these cases the condition generally described as "curby" or "sickle" hocks is represented (Plate XIII, Vol. I). It is also said that hocks, when small at their point of union with the canon—"tied-in" hocks, as they are termed—are specially prone to develop curbs.

The exciting causes of this disease are such as impose sprain or undue tension on the ligaments and tendons behind the hock; hence it results when animals are called upon to carry too much weight, and especially when young or out of condition. In any case, it may be induced by galloping in deep ground, jumping, kicking, rearing, and heavy draught.

Fig. 369.—Curb

Symptoms.—The existence of a curb is indicated by the presence of a curved or convex enlargement at the lower part of the hock behind, where it breaks the straight line which usually marks the course of the leg between the point of the hock and the fetlock (fig. 369). In some instances it is very slight, and the appearance may require to be verified by careful manipulation, while in others it presents a very considerable and pronounced enlargement. In the diagnosis of curb the fact must not be overlooked that in some horses whose hocks are "rough" or coarse in conformation, undue development of the head or upper extremity of the outer splint-bone may give the part a curby appearance, especially when the curb is viewed from the outer side. Careful examination, however, will show that the undue prominence is limited to the seat of the outer splint-bone, and does not extend across the back of the hock as in curb proper.

In addition to swelling, more or less heat, pain, and lameness usually result as the immediate effects of the injury. The action of the horse is peculiar in the fact that the animal, in endeavouring to relieve the injured part, throws the weight of the body on the toe or the front of the foot, according as the case is severe or otherwise, and progresses much after the manner of a horse suffering from spavin. In the slighter forms of the disease lameness is but little in evidence, and sometimes hardly perceptible, save when weight is placed on the back or special effort is made in draught.

Treatment.—When the injury is severe and the lameness acute, the horse must be placed in a state of absolute rest, and the part well fomented with hot water every three or four hours, and a hot bandage should be worn in the intervals. Strain on the injured structures should be removed by applying a high-heeled shoe to the foot and directing the weight towards the toe. A dose of physic and a temporary reduction of the corn ration will assist in dispersing existing inflammation. When this has been done a blister or two, with rest, will suffice to reduce the swelling. It is seldom that this is altogether removed, but where active treatment is promptly applied a great reduction may be effected in it. Hand-rubbing the part repeatedly with even pressure is often attended with benefit. In cases where the injury is slight, irrigation with cold water for a day or two, followed by a blister and a short rest, is all that is needed.

Fig. 370.—Curb

1, Good hock with curb. 2, Bad hock without curb. 3, Bad hock with curb.

Where the enlargement is considerable and lameness continues after these measures have been carried out, firing either by the puncturing or lining method will require to be adopted.

Young horses predisposed to curb should be carefully conditioned under slow exercise before being put to work.

In the laudable endeavour to restrict the spread of hereditary diseases in horses, the Royal Commission of Horse-breeding drew up a schedule of diseases, the existence of any one of which should disqualify a thoroughbred sire from receiving a premium. The list of disqualifying ailments included spavin, ring-bone, side-bone, diseases of the feet, cataract, roaring, and whistling, but curb, one of the most hereditary of horse diseases, had no place in it. It was not surprising, therefore, to find that a large percentage of the rejections at a recent show of the Hunters' Improvement Society were on account of curbs. It is no excuse for such a course to say, as has been said by some, that the lameness resulting from this disease sooner or later passes away, since the fact remains that it constitutes unsoundness, and largely depreciates the value of its victims.

BOWED KNEES

This affection is very common in foals at the time of birth, and to such an extent does it occasionally exist, that the breeder is doubtful as to whether the young animal will ever become upright upon his legs. However, it is often the case that young foals, more or less malformed in this direction, become quite straight upon their limbs as time goes on; indeed, such a formation is generally more pleasing to the breeder, if not present in too great a degree, than that called calf-kneed, a position the reverse of the one we have just described. In the latter case the anterior part of the fore-leg, in a line from above downwards, is concave, and the posterior part is convex; and while in knees bowed forward the owner looks for daily improvement in the form of his foal's legs, in the backward malformation he is assured from experience that no improvement can be anticipated. In the adult horse we occasionally observe "bowed knees" in legs that were originally upright, or perhaps had only a slight tendency to be bowed; the animal having been put to hard work on the road, or hunted for three or four years, by the time he has become eight years old his legs are so deformed, so much over at the knees, that while standing they appear incapable of supporting the weight of the fore parts of his body. There are many persons who consider such horses unsafe both to ride and drive; but experience teaches us that these fears are, to a great extent, unfounded. It is not to be understood, however, that we consider such a form of the fore-legs as safe as those we term perfect. But let us endeavour to ascertain what gives rise to this affection in the working horse, since to account for congenital deformity in the foal would be altogether beside the purpose.

Various hypotheses have been advanced as to what parts are implicated which would cause this alteration in the form of the carpus. Some persons consider it to depend on a relaxed and lengthened state of the extensors, others on that of the ligamentous tissue at the anterior part of the knee; and again there are others who assert that it consists in an inordinate contraction of the flexors, and to such an extent that the equilibrium of the two sets of muscles (namely, the flexors and extensors) is destroyed. Now, although the last hypothesis seems the most feasible, still the results of my dissections of the fore-legs of horses thus affected—and which were purposely selected—certainly do not confirm any of those opinions.

The only muscles likely to produce a curving forward of the knee are the three which flex the metacarpus on the carpus, their attachments being

superiorly to the condyles of the humerus, inferiorly to the trapezius, and two small metacarpal bones; but in these the scalpel develops nothing abnormal either in their muscular tissue or the tendinous structure by which they are inserted and intersected, nor should we expect to find anything, seeing their function is not interfered with.

At the posterior part of the carpus numerous ligaments are found, which are so arranged as to admit of extension only in a forward direction, while the bones present tuberous projections for the attachment of other ligaments, the direction of which is from above downwards, obliquely crossing each other (crucial).

May it not be that these ligaments at the posterior part of the knee become so deranged as to cause this affection? I am inclined to think such is the case. I know of nothing else that would so effectually prevent the full extension of the limb. It may be asked, What is the primary cause? Does the scalpel develop any lesion of this ligamentous tissue? In the specimens I have examined, all have shown the same peculiarities. I have carefully removed the muscles, both the flexors and extensors, taking care not to divide the annular ligaments, or, in fact, any of those proper to the carpus; after which I have endeavoured to straighten the leg, but invariably have failed. The abnormal position was persistent, and that to the same extent as before the muscles were removed. Further, to test the share the ligaments took in the flexure, I have made as many as four transverse sections through them, each of which was followed by an altered position of the bones, thus allowing the limb to be easily placed in a straight line, and of necessity leaving a considerable space between the divided ends of each ligament. The question that now arises is, Can anything be done to remedy this defect, either by the employment of the knife, mechanical contrivance, or any other means?

It would seem that the ligaments at the posterior parts of the carpus are in the first instance slightly sprained, giving rise to a disposition on the part of the animal to refrain from putting them on the stretch, as this, no doubt, would produce a certain amount of pain. To avoid this when standing the extensors are a little relaxed, thus allowing the knee to come somewhat forwards, thereby removing the tension of the ligaments posteriorly. This state of parts we observe only occasionally; for when the animal is excited, or at work, the limbs resume their natural position. This goes on for a time, but the cause alluded to being still in operation, the abnormal position becomes permanent; and the bursæ which are situated at the lateral, inclining to the posterior, part of the limb, a little above the knee, are now more than usually filled, which, if the animal be a valuable one, induces the owner to seek advice. This being determined on, it is

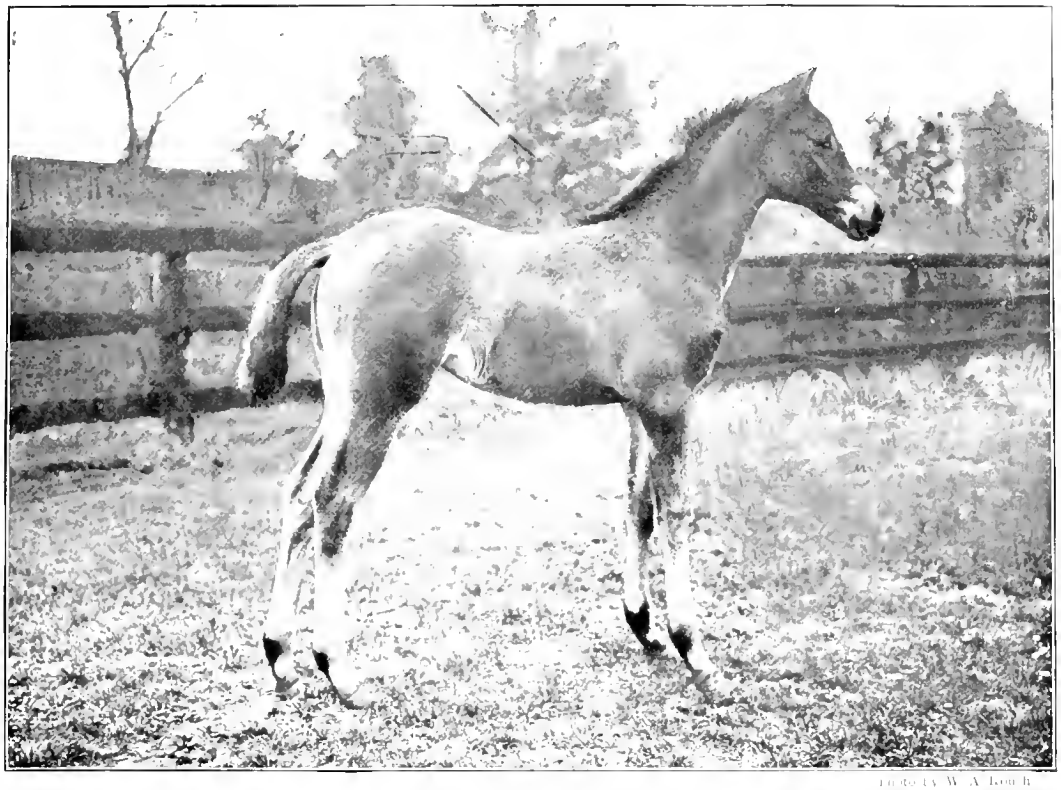


Photo by W. A. Booth

WELL-SHAPED FOAL

FOAL WITH BOWED LEGS

usually recommended that the horse be placed on a mash diet, and have a dose of purgative medicine administered to him, and that afterwards he be blistered once or twice and have a long rest —not less than two months. The general result of such a course of procedure is that the animal comes up much improved. He is put to work, which, if hard, in the course of two or three months causes his legs again to become as bad as ever. Still he is worked on, until finally he is permanently bowed at the knees, not being able, as when at first affected, to stand at times upright.

The impediment now consists in a slight thickening and consequent shortening of the ligamentous tissue we have before referred to.

No treatment in this advanced stage would be of any avail, whether medicinal, surgical, or mechanical. Such a horse must be considered as unsound, if the affection exist in more than a slight degree; for although we daily observe horses thus deformed doing their work well, still, on the other hand, many of them show blemished knees, the result of falls.

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17. THE MUSCULAR SYSTEM

There are two kinds of muscle, distinguished as *striated* or *voluntary* and *non-striated* or *involuntary*.

Striated muscle is red in colour, and forms nearly one-half of the entire weight of the body. It clothes the bones of the skeleton and moves them in obedience to the will, hence the term "voluntary" muscle.

A voluntary muscle consists of an aggregation of bundles of fibres united by connective tissue in which blood-vessels and nerves ramify to nourish and innervate them.

A muscle fibre, as seen under the microscope, is a minute, pale, faintly yellow filament. It is composed of an outer sheath or *sarcolemma*, within which is contained a *contractile substance*.

The sheath is a very thin, transparent, structureless membrane. It possesses no power to contract, but, being elastic, is capable of accommodating itself to the necessary changes which its contents undergo.

The contractile substance enclosed in the sarcolemma consists of a number of delicate filaments placed side by side, termed *fibrillæ*. Each fibrilla is composed of a chain of minute bodies called *sarcous elements*.

These are united in such a way as to give the fibre a succession of transverse markings, hence the term *striated* muscle; other but less distinct striations occur along its length, as a result of the contact of the several fibrillæ.

Non-striated muscle is of a pale grayish hue, and enters into the structure of hollow organs, such as the stomach and bowels, the uterus and bladder, the blood-vessels, the bronchial tubes, &c. &c. It consists of a number of minute spindle-shaped fibre-cells, about $\frac{1}{4500}$ to $\frac{1}{3500}$ of an inch in breadth and $\frac{1}{600}$ to $\frac{1}{300}$ of an inch in length. Non-striated muscle is not under the control of the will, its movements are therefore involuntary, and carried on by reflex action.

Voluntary muscles are distinguished from one another by various names. Of these some refer to their action. Those which bend a joint, for instance, are termed flexors, while others which straighten it again are known as extensors. There are also levators, depressors, abductors, adductors, constrictors, dilators, &c. &c.

Others are distinguished by their length, as the long muscle of the back, *longissimus dorsi*, the short muscle of the tongue, *hyo-glossus brevis*. Size, form, position, direction, and other qualities are also invoked as a means of recognition.

Voluntary muscles, with few exceptions, exist in pairs– one on either side of the body or organ in whose function they are engaged. They are attached by their extremities to two or more bones, which they cause to move at the instigation of the will.

When in action one extremity of the muscle is fixed, the other is movable. The former is termed its *origin*, or the part *from* which it acts; the latter is its *insertion*, or the part *upon* which it acts and moves. In some instances the extremities are alternately fixed and movable; what is at one time the origin is at another the insertion. This is the case with the mastoido-humeralis, a long muscle running from the arm to the back of the head. If when the arm is fixed the muscle contracts, the head is drawn downwards and to one side; and conversely when the head is fixed, the arm is raised.

Tendons.—Muscles are attached to bones either directly by their fleshy fibres or by tendons which proceed from them. Tendons transmit the action of muscles to the bones to be acted upon. They exist in the form of dense rounded cords of various lengths, or as more or less broad, flat, expanded sheets. In the latter condition they are spoken of as *aponeurotic* tendons, and are found in their highest development in connection with the muscles of the belly, where they assist in forming the abdominal walls. The long cord-like variety are met with in the extremities, where the more important extend from above the knees and hocks downward to the feet and pasterns.

Some tendons are partly or completely surrounded by a fibrous sheath, and this is lined by a synovial membrane, which, being also reflected on to

the tendon, enables the latter to move freely through the former. This is more especially the case in the vicinity of joints, as the knee, hock, and fetlock, where movement is most active. Where tendons play over projecting points of bone or other prominences, a small, round sac lined with synovial membrane is placed between them to facilitate the movement of the one over the other. These are known as synovial bursæ.

MUSCLES OF THE FACE AND HEAD

The muscles of the face comprise a number of longer or shorter strips, most of which are attached by one extremity to the bones above, and by the other to parts about the lips and nostrils below. Those attached to the

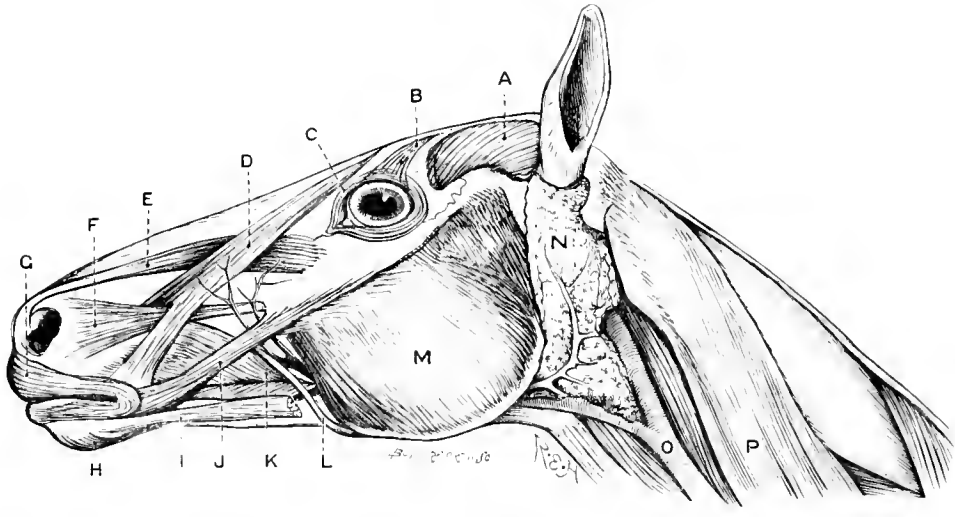


Fig. 371.—Muscles of Horse's Head

A, Temporalis muscle. B, Levator palpebræ. C, Orbicularis palpebrarum. D, Supernaso-labialis or Levator labii superioris alæque nasi. E, Supermaxilo-labialis or Levator labii superioris proprius. F, Supermaxilo-nasalis or Dilator naris lateralis. G, Orbicularis oris. H, Mento-labialis. I, Maxilo-labialis or Depressor labii inferioris. J, Zygomaticus. K, Buccinator. L, Parotid duct. M, Masseter muscle. N, Parotid gland. O, Jugular vein. P, Mastoido-humeralis muscle.

former are for the most part muscles of prehension, and serve to gather up the food and retain it in the mouth during mastication. With one or two exceptions the muscles of the face are arranged in pairs, one being on one side and the other on the other.

When in action some of them draw the lips upwards, others acting in an opposite direction pull them downwards, hence they are called levators and depressors respectively.

The orifice of the mouth is acted upon by a single muscle that encircles the lips (*orbicularis oris*), and when in action diminishes

the size of the opening, as may be seen in the act of drinking. A similar muscle (*orbicularis palpebrarum*) surrounds the eyelids, which it closes.

Besides these there are others much larger and stronger, one forming the anterior part of the cheeks (*buccinator* and *caninus*). These are attached to the upper and lower jaw, along the margins of the sockets which contain the fangs of the molar teeth. When in action they throw the food out of the channel of the cheek on to the grinding surface of the teeth.

Other muscles in this region are engaged in dilating the nostrils, and thus ministering to the function of respiration.

Name.	Origin.	Insertion.	Action.
Levator Palpebræ Superioris Externus.	From the external surface of the frontal bone.	Into the upper eyelid.	To raise the upper eyelid.
Orbicularis Palpebrarum.	Surrounds the eyelids. Arises from a small tubercle on the lachrymal bone.	Into the skin of the eyelids.	To close the eyelids.
Levator Palpebræ Superioris Internus.	From the bottom of the orbit behind the eye.	Into the upper eyelid.	To raise the upper lid.
Zygomaticus.	From the outer surface of the masseter muscle.	Into the angle of the mouth.	To retract the angle of the mouth.
Levator Labii Superioris Alæque Nasi.	From the frontal and nasal bone.	Into the outer part of the nostril and the angle of the mouth.	To dilate the nostril and draw the angle of the mouth upwards.
Levator Labii Superioris.	From the malar and the superior maxilla or upper jaw-bone.	Joining the tendon of its fellow on the opposite side, it is inserted into the upper lip.	To elevate the upper lip and draw it to one side.
Dilator Naris Lateralis.	From the anterior part of the superior maxilla or upper jaw-bone.	Into the side of the nostril and upper lip.	To dilate the nostril and draw the upper lip backward.
Dilator Naris Anterior.	A small, single muscle attached to the front of the nasal cartilages.		To dilate the nostrils.
Depressor Labii Inferioris.	From the anterior border of the lower jaw behind the molar teeth.	To the skin of the lower lip.	To depress the under lip.

Name.	Origin.	Insertion.	Action.
Buccinator and Caninus.	Attached to the tuberosity of the superior maxilla, to the anterior border of the inferior maxilla behind the last molar tooth, and to the outer surface of the sockets of the molar teeth of the upper and lower jaw. Below it blends with the angle of the mouth.		To keep the food between the upper and lower molar teeth during mastication.
Orbicularis Oris.	Has no bony attachment.	Encircles the lips.	Closes the lips and assists in gathering the food, in drinking, and in mastication.
Dilator Naris Superioris.	From the side of the nasal peak.	Into the false nostril and the anterior turbinated bone.	To dilate the false nostril.
Dilator Naris Inferioris.	From the anterior and superior maxillary bones.	Into the cartilage at the anterior extremity of the posterior turbinated bone.	To dilate the false nostril.
Depressor Labii Superioris.	From the anterior maxillary bone above the upper incisor teeth.	Into the upper lip.	To depress the upper lip.
Levator Menti.	From the lower jaw beneath the incisor teeth.	Into the substance of the chin.	To raise the lower lip.

Masseter.—A broad, thick, square muscle situated on the outer face of the lower jaw. It is largely intersected by tendinous layers and covered by a strong fibrous membrane.

Origin.—From the zygomatic ridge of the upper jaw-bone by a strong broad tendon.

Insertion.—Into the external surface of the upper broad portion of the inferior maxilla or lower jaw.

Action.—It brings the teeth of the lower jaw forcibly into contact with those of the upper in grinding the food. It is the most powerful of the muscles engaged in mastication.

Pterygoideus Internus.—A broad, thick, flat muscle situated on the internal aspect of the superior broad portion of the lower jaw.

Origin.—From the sphenoid and palatine bones.

Insertion.—Into the inner surface of the lower jaw opposite the masseter.

Action.—To bring the lower jaw into contact with the upper, and to move it from side to side in the process of mastication or grinding the food.

Pterygoideus Externus.—A short, thick, fleshy muscle situated within and in front of the articulation of the lower jaw with the temporal bone.

Origin.—From the sphenoid bone at the base of the skull.

Insertion.—Into the inner part of the neck of the lower jaw below the articular condyle.

Action.—To move the lower jaw forward and to one side in the act of mastication.

Temporalis.—This muscle lies on the side and front of the cranium, extending into the temporal fossa.

Origin.—From the outer surface of the parietal, squamous temporal, and frontal bones, in the temporal fossa, and from the sphenoid bone.

Insertion.—Into the coronoid process of the lower jaw and the anterior border of the same bone continuous with it.

Action.—To assist in masticating the food by bringing the lower jaw into contact with the upper and moving it from side to side.

Stylo-Maxillaris.—This is a short, thick muscle situated in the region of the throat.

Origin.—From the styloid process of the occipital bone above in company with another small muscle—the digastricus.

Insertion.—Into the angle of the lower jaw.

Action.—By pulling the last-named bone away from the upper jaw it opens the mouth.

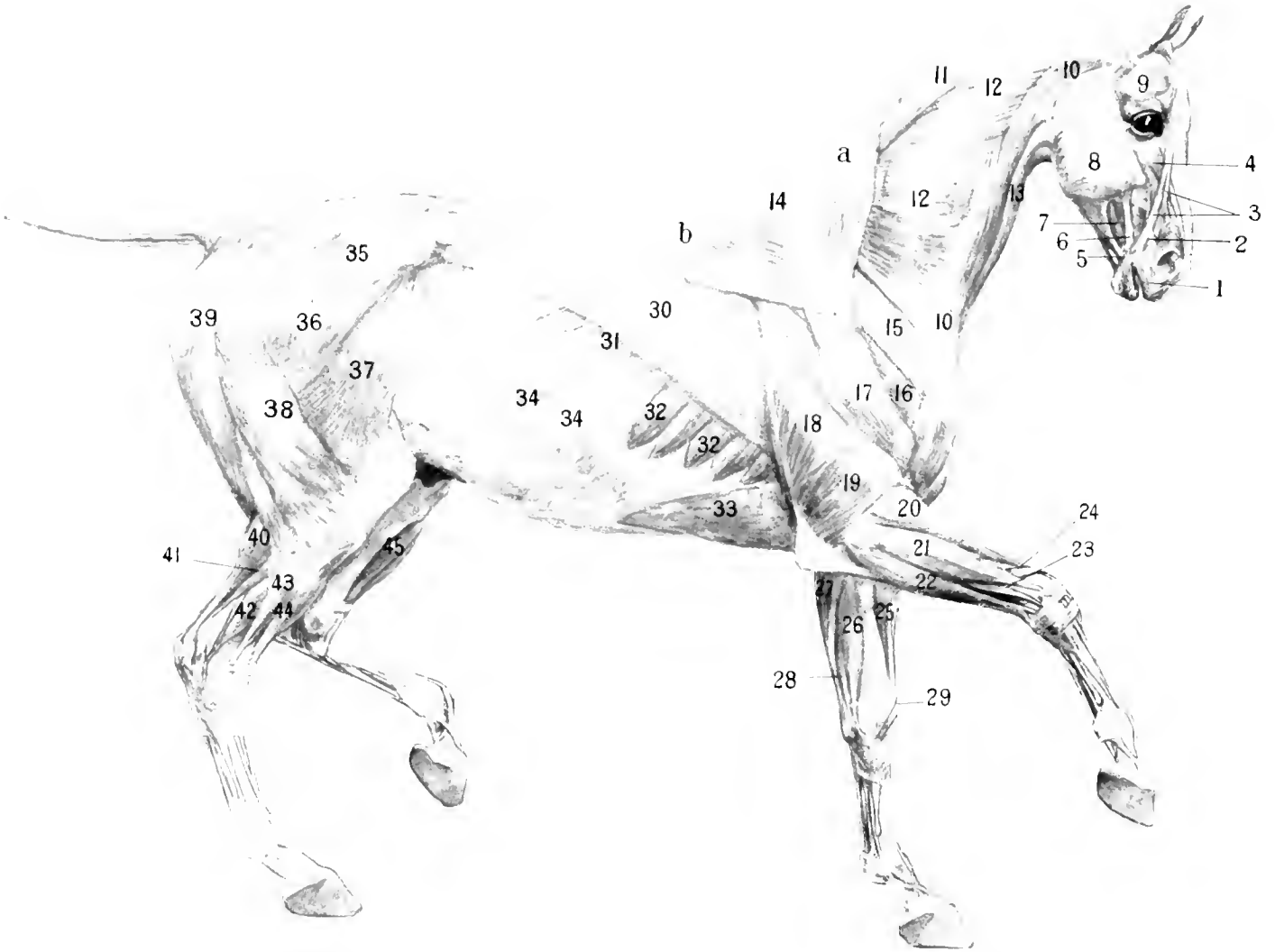
MUSCLES OF THE EXTERNAL EAR

The external ear consists of a short bony tube projecting from the petrous temporal bone, termed the external auditory canal, together with three pieces of cartilage, and a number of muscles, vessels, and nerves, &c.

The **Cartilages** are distinguished as the conchal the annular, and the scutiform. The conchal cartilage forms the framework of all that portion of the ear which stands erect. It presents a large vertical opening on one side for the reception of sound, and is attached below to the annular cartilage, a small ring of gristle connected with the auditory process of the petrous temporal bone. The scutiform cartilage is a small, flat, somewhat

THE SUPERFICIAL MUSCLES EXPOSED

1. Orbicularis oris.
2. Dilatator naris lateralis.
3. Levator labii superioris alæque nasi.
4. Levator labii superioris proprius.
5. Depressor labii inferioris.
6. Zygomaticus.
7. Buccinator.
8. Masseter.
9. Temporalis.
10, 10. Mastoido-humeralis.
11. Rhomboideus.
12, 12. Splenius.
13. Sterno-maxillaris.
14. Trapezius { (*a*) Cervical division. (*b*) Dorsal division.
15. Supraspinatus.
16. Infraspinatus.
17. Deltoid.
18. Caput magnum.
19. Caput medium.
20. Extensor metacarpi magnus.
21. Extensor pedis.
22. Flexor metacarpi externus.
23. Extensor suffraginis.
24. Extensor metacarpi obliquus.
25. Extensor metacarpi magnus.
26. Flexor metacarpi internus.
27. Ulnaris accessorius.
28. Flexor metacarpi medius.
29. Extensor metacarpi obliquus.
30. Latissimus dorsi.
31, 31. Serratus anticus.
32, 32. Serratus magnus.
33. Posterior deep pectoral.
34, 34. Intercostal muscles.
35. Gluteus medius.
36. Superficial gluteus.
37. Tensor vaginæ femoris.
38. Biceps femoris.
39. Semi-tendinosus.
40. Gastrocnemius.
41. Solens.
42. Flexor pedis.
43. Peroneus.
44. Extensor pedis.
45. Flexor metatarsi.



THE SUPERFICIAL MUSCLES EXPOSED

triangular cartilaginous plate situated in the front of the base of the concha, to which it is attached. The cartilages of the ear are for the purpose of collecting and transmitting sound to the essential organ of hearing within the temporal bone, and to effect this purpose they, and especially the concha, require to be moved in various directions. This is effected by means of the following muscles, which are connected with them:

Zygomatico-Auricularis. This comprises two thin slips of muscle *arising* from the zygomatic process of the squamous temporal bone. They

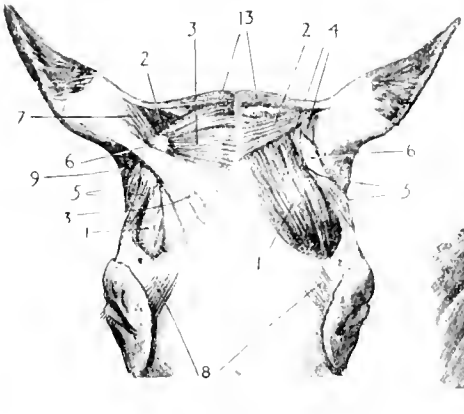


Fig. 372.—Muscles of the Ear. (Anterior aspect; outer and deep layers.)

Fig. 373.—Muscles of the Ear. (Lateral aspect.)

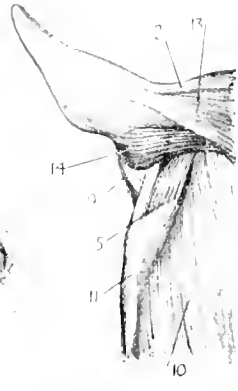


Fig. 374.—Muscles of the Ear. (Posterior aspect.)

1, Temporalis. 2, Parieto-auricularis internus. 3, Parieto-auricularis externus. 4, Scuto-auricularis internus. 5, Zygomatico-auricularis. 6, Scutiform Cartilage. 7, Scuto-auricularis externus. 8, Corrugator Supercilii. 9, Parotido-auricularis. 10, Splenius. 11, Tendon of Sterno-cleido-mastoideus. 12, Masseter. 13, Cervico-auricularis externus. 14, Cervico-auricularis medius. 15, Obliquus Capitis Superior.

become *inserted* into the scutiform cartilage, and into the outer and inferior part of the concha.

Action.—To draw the ear forward.

Parieto-Auricularis Externus.—A broad, thin muscle spread over the superior part of the forehead and covering the temporalis muscle.

Origin.—From the parietal crest or bony ridge in the centre of the forehead.

Insertion.—By two slips, one to the inner margin of the scutiform cartilage and the other to the inner and anterior part of the conchal cartilage.

Action.—To draw the ear inwards and direct the opening forward, as when "pricked"

Scuto-Auricularis Externus.—This muscle attaches the scutiform cartilage to the inner side of the concha. It assists in drawing the ear inwards and directing the opening forward.

Cervico-Auricularis.—Three muscles are included in this term—the superficial, the middle, and the deep.

Origin.—All three arise from the ligamentum nuchæ at the summit of the head, where they are placed one upon another.

Insertion.—The *superficial* cervico-auricularis is inserted into the middle of the inner surface of the concha, the *middle* one into the outer side of the same cartilage, and the *deep* one into the posterior aspect of its base.

Action.—To turn the ear so that its opening shall be directed outward or backward.

Parotido-Auricularis.—A long, thin, ribbon-shaped muscle situated on the external surface of the throat in contact with the parotid gland.

Origin.—From the outer surface of the parotid gland, from which it ascends to be inserted into the outer part of the base of the concha, immediately beneath the opening.

Action.—To abduct or move the ear outward.

Parieto-Auricularis Internus.—A triangular muscle placed beneath the one last described.

Origin.—From the superior part of the parietal crest.

Insertion.—Into the inner side of the base of the conchal cartilage.

Action.—To draw the ear inward towards the centre of the poll.

Scuto-Auricularis Internus.—This muscle is composed of two small divisions, which cross each other somewhat obliquely.

Origin.—From the inner surface of the scutiform cartilage.

Insertion.—Into the posterior part of the base of the concha.

Action.—Assists in directing the opening of the ear outwards, and also backwards when required.

Mastoido-Auricularis.—A very small muscle, situated at the inner side of the root of the ear.

Origin.—From the margin of the auditory process of the petrous temporal bone.

Insertion.—Into the base of the conchal cartilage.

Action.—Not definitely known.

The basement cartilages of the ear rest upon a cushion of fat, which facilitates their rapid movement in various directions.

MUSCLES OF THE HYOID REGION

Mylo-Hyoid.—This muscle is situated beneath the tongue and between the branches of the lower jaw. With its fellow they stretch across from one branch to the other, and support the tongue as in a sling.

Origin.—From the inner face of the lower jaw behind the molar teeth.

Insertion. From the point of origin its fibres pass under the tongue and meet those of the muscle from the opposite side in the centre, where they blend together. Behind they are inserted into the spur-like projection of the tongue bone.

Action.—This muscle lifts the tongue towards the palate, and assists in mastication and swallowing.

Genio-Hyoideus.—This is a long, narrow muscle, with tapering extremities, situated beneath the tongue.

Origin.—From the lower jaw, near the symphysis or joining of the two branches.

Insertion.—Into the spur-process of the hyoid or tongue bone.

Action.—To draw the hyoid bone forward and assist in protruding the tongue.

Stylo-Hyoid.—Situated in the region of the throat.

Origin.—From the superior and posterior part of the long cornu of the hyoid or tongue bone.

Insertion.—Into the outer part of the heel-like process of the same bone, where its tendon divides to allow the middle tendon of the digastricus to pass between its branches.

Action.—To draw the larynx and the tongue backwards and upwards.

Hyoideus Transversus.—This is a small single muscle placed between the two small cornua of the tongue bone. It is attached to the inner surface of each, and crosses over from one side to the other.

Action.—To maintain the small cornu in position during the various movements of the tongue.

Kerato-Hyoid. A small, flat, triangular muscle situated at the root of the tongue.

Origin.—From the posterior border of the lower end of the long cornu, and from the posterior border of the small cornu.

Insertion.—Into the upper border of the heel process of the tongue bone.

Action.—To raise the heel process and elevate the larynx.

The Digastricus.—This is composed of two small muscular masses united by a short tendon; hence it is called digastric or a double-bellied muscle.

Origin.—With the stylo-maxillaris from the styloid process of the occipital bone. The tendon intervening between the two bellies plays through a division above referred to in the tendon of another muscle (stylo-hyoid) against the tongue bone.

Insertion. The second belly is inserted into the posterior border of the lower jaw behind the chin.

Action.—To raise the hyoid bone and assist in opening the mouth.

Occipito-Styloid.—A very short, small, flat muscle situated at the posterior part of the base of the skull.

Origin. From the anterior part of the styloid process of the occipital bone.

Insertion. Into the upper extremity of the long cornu of the hyoid bone (bone of the tongue).

Action.—To draw the bone of the tongue upwards and backwards.

MUSCLES OF THE TONGUE

Stylo-Glossus.—A long, narrow, flat muscle situated on the side of the tongue.

Origin.—From the outer part of the inferior extremity of the long cornu of the tongue bone.

Insertion.—Into the tip of the tongue.

Action.—Acting with its fellow on the opposite side, it would pull the tip of the tongue upwards. Acting alone, it would draw it to one side.

Great Hyo-Glossus.—Situated in the substance of the tongue.

Origin.—From the heel-like process and body of the tongue bone.

Insertion.—Into the front part of the mucous membrane of the tongue along the greater portion of its length.

Action.—To draw the tongue backwards and upwards.

Genio-Hyo-Glossus.—A broad, thin, fan-shaped muscle placed in the centre of the tongue. Some of its fibres pass downwards to the tip, others to the centre, and a third portion to the root of the tongue.

Origin.—From the inner surface of the lower jaw, near the symphysis, or union of the two branches.

Insertion.—Into the under surface of the mucous membrane, along its middle, from the tip to the root.

Action.—The lower portion of the muscle when contracting would draw the tongue into the mouth, the upper division would cause it to protrude. The central part would pull it away from the roof.

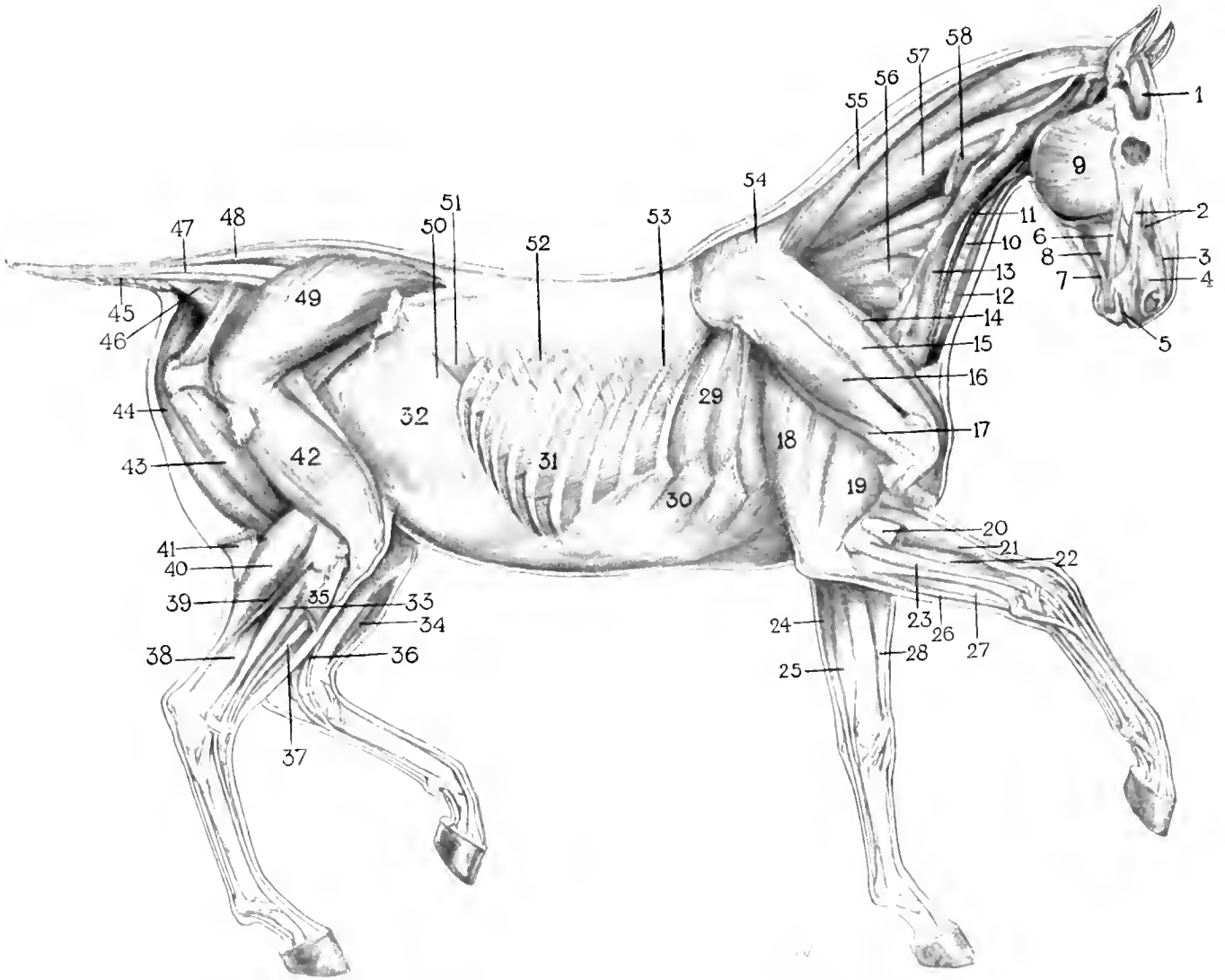
Small Hyo-Glossus.—A very small muscle surrounded by fat and situated at the root of the tongue.

Origin.—From the inferior extremity of the small cornu and the body of the tongue bone.

Insertion.—Into the posterior part of the substance of the tongue.

SECOND LAYER OF MUSCLES EXPOSED

1. Temporalis.
2. Levator labii superioris alaeque nasi.
3. Levator labii superioris.
4. Dilator naris lateralis.
5. Orbicularis oris.
6. Zygomaticus.
7. Depressor labii inferioris.
8. Buccinator.
9. Masseter.
10. Trachea.
11. Jugular vein.
12. Sterno thyro-hyoideus.
13. Scalenus.
14. Anterior deep pectoral.
15. Supraspinatus.
16. Infraspinatus.
17. Teres minor.
18. Caput magnum.
19. Caput medium.
20. Extensor pedis.
21. Extensor metacarpi magnus.
22. Extensor metacarpi obliquus.
23. Extensor suffraginis.
24. Flexor pedis perforatus.
25. Flexor metacarpi internus.
26. Ulnaris accessorius.
27. Flexor metacarpi externus.
28. Extensor metacarpi magnus.
29. Serratus magnus.
30. Obliquus abdominis externus.
31. External intercostals.
32. Obliquus abdominis internus.
33. Peroneus.
34. Flexor metatarsi.
35. Flexor metatarsi in section.
36. Flexor accessorius.
37. Extensor pedis.
38. Flexor perforans.
39. Plantaris.
40. Gastrocnemius.
41. Semitendinosus in section.
42. Vastus externus.
43. Adductor magnus.
44. Semimembranosus.
45. Depressor coccygis.
46. Compressor coccygis.
47. Curvator coccygis.
48. Erector coccygis.
49. Middle gluteus.
50. Obliquus abdominis internus.
51. Retractor costæ.
52. Serratus posticus.
53. Serratus anticus.
54. Rhomboideus (dorsal portion).
55. Rhomboideus (cervical portion).
56. Levator anguli scapulæ.
57. Splenius.
58. Mastoido-humeralis in section.



SECOND LAYER OF MUSCLES EXPOSED

In passing forward to its insertion it crosses over the hyoideus transversus.

Action.—To retract the tongue.

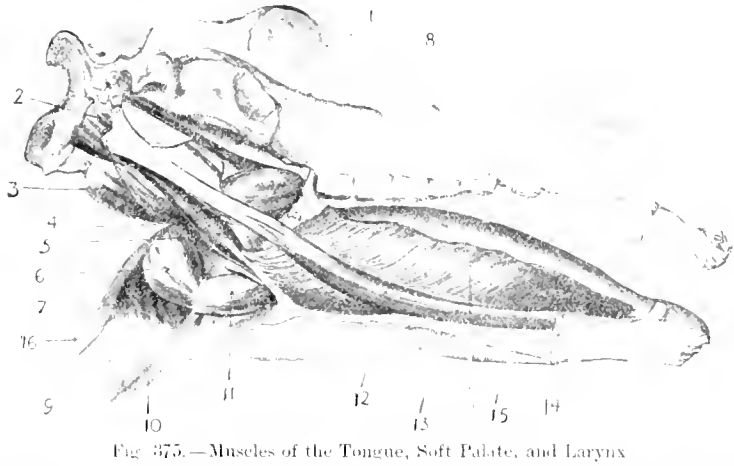


Fig. 375.—Muscles of the Tongue, Soft Palate, and Larynx.

1, Tensor Palati. 2, Occipito-Stylohd (right). 3, Occipito-Styloid (left). 4, Palato-Glossus. 5, Stylo-Hyoid Pharyngeus. 6, Thyro-Pharyngeus. 7, Crico-Pharyngeus. 8, Palato-Pharyngeus. 9, Crico-Thyroideus. 10, Sterno-Thyroideus. 11, Thyro-Hyoideus. 12, Stylo-Glossus. 13, Genio-Hyoideus. 14, Great Hyo-Glossus. 15, Genio-Hyo-Glossus. 16, Œsophagus.

Palato-Glossus.—A small collection of muscle fibres arising from the side of the pharynx and becoming inserted into the root of the tongue.

Action.—To constrict the fauces.

MUSCLES OF THE PHARYNGEAL REGION

Pterygo-Pharyngeus.—A thin, flat, triangular muscle lying above the pharynx.

Origin.—From the pterygoid process, from which its fibres spread out fan-like and become inserted into the upper and lateral aspect of the pharynx. Some of its fibres intermix with those of the palato-pharyngeus.

Action.—To constrict the pharynx.

Hyo-Pharyngeus.—A small muscle situated on the inferior and lateral parts of the pharynx in front.

Origin.—From the heel process of the hyoid bone.

Insertion.—Into the roof of the pharynx, where its fibres interlace with those of its fellow.

Thyro-Pharyngeus.—Situated behind the one last described.

Origin.—From the outer surface of the thyroid cartilage.

Insertion.—Into the roof of the pharynx, where its fibres interlace with those of its fellow.

Crico-Pharyngeus.—Placed behind the thyro-pharyngeus.

Origin.—From the outer surface of the cricoid cartilage.

Insertion.—Into the roof of the pharynx, where its fibres interlace with those of its fellow.

Action.—The three muscles last described constrict the pharynx.

Stylo-Pharyngeus.—A triangular muscle situated above the pharynx.

Origin.—From the inner surface of the long cornu of the hyoid bone.

Insertion.—Below it spreads out its fibres and becomes inserted into the outer edge of the pharynx.

Action.—To dilate the pharynx.

MUSCLES OF THE SOFT PALATE

Palato-Pharyngeus. This muscle lies in the posterior part of the soft palate. It is attached to its fellow on the opposite side, to the outer wall of the pharynx, and to the superior border of the thyroid cartilage.

Action.—To tighten the soft palate, and raise it during swallowing.

Tensor Palati.—A small, flat, thin muscle placed above the pharynx.

Origin.—From the styloid process of the petrous temporal bone.

Insertion.—The tendon of this muscle plays over a pulley-like arrangement on the free process of the pterygoid bone, and, after spreading out, becomes inserted into the posterior wall of the pharynx.

Action.—To render the front portion of the palate tense.

Levator Palati.—A thin band of muscle situated above the pharynx.

Origin.—With the muscle last described from the styloid process of the temporal bone.

Insertion.—Into the soft palate.

Action.—To raise the velum palati.

MUSCLES OF THE LARYNX

Thyro-Hyoid Muscle.—A flat triangular muscle spread over the side of the thyroid cartilage.

Origin.—From the entire length of the heel process of the hyoid or tongue bone.

Insertion.—Into an oblique ridge on the outer side of the thyroid cartilage.

Action.—To raise the larynx and draw it forward.

Hyo-Epiglottideus.—A short, small bundle of fibres situated at the root of the tongue in a mass of fatty tissue.

Origin.—From the upper surface of the body of the hyoid bone.

Insertion.—Into the front and lower part of the epiglottis.

Action.—To draw the epiglottis forward and downward after it has been pushed over the glottis in the act of swallowing.

Crico-Thyroid Muscle.—A small, narrow muscle placed on the outer side of the cricoid cartilage.

Origin.—From the upper and anterior part of the cricoid cartilage.

Insertion.—Into the inferior part of the thyroid cartilage.

Action.—To maintain the two cartilages in position during the action of the more movable parts, while at the same time permitting a certain amount of liberty between themselves.

Posterior Crico-Arytenoid Muscle.—It occupies the upper and back part of the larynx, a great portion of which it covers. It is the largest and most powerful of the intrinsic muscles connected with this organ.

Origin.—From the posterior broad surface of the cricoid cartilage.

Insertion.—Into the outer angle of the arytenoid cartilage.

Action.—To draw the arytenoid cartilages apart and dilate the opening into the larynx.

Lateral Crico-Arytenoid Muscle.—A small muscle situated on the upper and posterior part of the larynx.

Origin.—From the upper part of the anterior border of the cricoid cartilage.

Insertion.—Its fibres, passing upwards and backwards, become inserted into the outer angle of the arytenoid cartilage with the posterior crico-arytenoid muscle.

Action.—To constrict the laryngeal opening.

Thyro-Arytenoid Muscle.—This muscle is composed of two small bundles of fibres situated on the inner side of the thyroid cartilage, where they are separated from each other by the interposition of a pouch of mucous membrane (ventricle of the larynx).

Origin.—From the inner surface of the body of the thyroid cartilage.

Insertion.—By some of its fibres into the outer border of the arytenoid cartilage. Others mingle with those of the arytenoid muscle.

Action.—To constrict the larynx.

Arytenoideus Muscle.—A pair of small muscles situated on the upper and posterior surface of the arytenoid cartilages. They are united in the middle line by the intermixing of their fibres, and are inserted into the posterior surface of the arytenoid cartilage.

By some this muscle is said to constrict the laryngeal opening, and by others to dilate or open it.

MUSCLES OF THE NECK

Rhomboideus.—This is a long triangular muscle situated at the upper border of the neck, where it commences at the second cervical vertebra and extends backward to the fifth dorsal vertebra.

Origin.—From the superior border of the ligamentum nuchæ and the superior spinous processes of the 2nd, 3rd, 4th, and 5th dorsal vertebræ.

Insertion.—Into the inner surface of the cartilage on the upper border of the scapula.

Action.—To draw the scapula upwards and forwards. Acting when the scapula is fixed, it would incline the neck to one side.

Levator Anguli Scapulæ.—A muscle of considerable size spread over the lower half of the side of the neck, from which its fibres converge toward the cervical angle of the scapula.

Attachments.—To the transverse processes of the four or five posterior cervical vertebræ, and to the internal surface of the upper extremity of the scapula, just in front of the serratus magnus.

Action.—This muscle, like the one previously described, may act from either extremity. When the neck is made a fixed point it would pull forward the upper end of the scapula and cause the shoulder point to recede. When the scapula is fixed, the muscle acting alone would draw the neck to one side, or, acting with its fellow, the neck would be lifted up.

Splenius.—A broad, triangular, flat muscle, situated on the side of the neck, and extending from the summit of the head backward to the withers.

Origin.—From the superior spinous processes of the 2nd, 3rd, and 4th dorsal vertebræ and the upper border of the ligamentum nuchæ.

Insertion.—Into the mastoid crest of the temporal bone and the transverse processes of the first five cervical vertebræ.

Action.—Acting alone, the splenius draws the head and neck towards the side upon which it acts. When co-operating with its fellow on the opposite side, they elevate the head and neck.

The Complexus.—This is a strong, fleshy muscle deeply seated on the side of the neck, in close apposition with the ligamentum nuchæ, which divides the right from the left complexus. It extends from the back behind to the head in front, becoming narrower as it passes upwards.

Origin.—From the spinous processes of the 1st, 2nd, 3rd, and 4th dorsal vertebræ, from the transverse processes of the first six, and from the articular tubercles of all the cervical vertebræ.

Insertion.—Into the posterior part of the occipital bone.

Action.—Contracting alone, it would bend the neck to one side. Acting together with its fellow on the opposite side, it elevates and extends the head.

Trachelo-Mastoideus.—Situated on the side of the neck beneath the splenius. It is a long muscle, composed of two fleshy divisions which pass from the head downwards to the anterior extremity of the back.

Origin.—It takes its origin from the transverse processes of the first two dorsal vertebræ, and from the articular tubercles of the last six cervical vertebræ.

Insertion.—Into the mastoid process of the temporal bone, and to the wing of the atlas by a flat tendon common to the splenius and mastoido-humeralis.

Action.—When acting alone, the trachelo-mastoideus draws the head and neck to one side. When acting with the corresponding muscle of the other side, it raises the head.

Spinalis Colli.—Five thick, short strands of muscle deeply seated on the side of the neck in proximity with the bones. They are in continuation of similar short muscular fasciculi, presently to be noticed, in the regions of the back and loins.

Origin.—From the oblique processes of the five posterior cervical vertebræ or neck bones.

Insertion.—Into the spinous processes of the 2nd, 3rd, 4th, 5th, and 6th of the same.

Action.—To extend the neck, and to fix the bones in accordance with the action of other of the cervical muscles.

Intertransversales Colli.—These are six short muscles placed on the side of the neck in apposition with the vertebræ. Each extends from the oblique process of one vertebra to the transverse process of the one preceding it, except in the case of the two first.

Action.—To draw the neck to one side.

Obliquus Capitis Superior.—A short, thick, square muscle situated on the side of the poll. It is largely intersected by strands of tendinous tissue, and covers over the articulation between the occiput and the first cervical vertebra.

Origin.—From the anterior border and under surface of the wing of the atlas.

Insertion.—Into the mastoid crest and the styloid process of the occiput.

Action.—To incline the head to one side and to assist in extending it.

Obliquus Capitis Inferior is a thick, fleshy muscle, somewhat longer than the last described, and situated immediately below it.

Origin. From the outer surface of the superior spinous process of the second cervical vertebra (axis or dentata).

Insertion. Into the superior surface of the wing of the atlas.

Action. To rotate the atlas on the dentata. Its action is shown in a striking manner when the horse shakes his head.

Rectus Capitis Posticus Major.—A short, fleshy muscle placed beneath that last described, and partly divisible into two portions.

Origin.—From the superior spinous process of the dentata or second cervical vertebra.

Insertion.—Into the posterior part of the occipital bone.

Action.—Assists the complexus major in extending the head on the neck.

Rectus Capitis Posticus Minor.—A small, wide, flat muscle placed beneath that last described, and extending over the articular capsule of the joint formed by the occiput and the first cervical vertebra.

Origin.—From the superior surface of the atlas.

Insertion.—Into the posterior surface of the occiput.

Action.—It assists in extending the head on the neck.

Cervical Panniculus.—This is a thin layer of muscular tissue spread over the front of the neck, extending from the breast below, upward, to behind the jaws, and on to the sides of the face.

Below, it is attached to the cariniform cartilage of the sternum, to which it converges from either side. Above, it becomes closely adherent to the muscles in front of the neck, which it braces and supports.

Cervical Trapezius.—See muscles of the back.

Mastoido-Humeralis.—This is a long, broad, fleshy muscle, extending from the top of the head downward along the side of the neck over the point of the shoulder to the humerus or upper arm bone.

Origin.—Above from the mastoid process and crest of the occipital bone, and from the transverse processes of the first four cervical vertebrae.

Insertion.—Into the upper third of the ridge on the outer part of the humerus.

Action.—This is a muscle of considerable power and importance, being specially instrumental in raising the limb from the ground and carrying it forward in progression. Upon it chiefly depends that grand shoulder action so much admired in our best harness horses.

It is capable of acting in two directions: when the head is fixed it raises and advances the fore-limb; when the fore-limb is fixed, as in a standing posture, it draws the head to one side, or, acting with its fellow on the opposite side, it pulls it downward.

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